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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
Comments:	Sent final report to client via onedrive link.			

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EPA INFORMATION COLLECTION REQUEST
QUENCH TOWER TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

PFID: 256899
Source IDs: Quench Tower Stack
Permit #: TV-65-00853

Test Dates: October 25-November 2, 2016

Report Date: April 13, 2017

Prepared for:

ArcelorMittal Monessen LLC
345 Donner Avenue
Monessen, Pennsylvania 15062

Prepared by:

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PA Lab Registration #02-04775

Project No. 16-167

MONTROSE
AIR QUALITY SERVICES

CERTIFICATION STATEMENT

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

EPA INFORMATION COLLECTION REQUEST
QUENCH TOWER TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

Test Dates: October 25-November 2, 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

Disclaimer – This document is intended solely for the use of the individual to whom it is addressed and others authorized to receive it.

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EPA INFORMATION COLLECTION REQUEST
QUENCH TOWER 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 Quench Tower for the ArcelorMittal Monessen Coke Plant in Monessen, Pennsylvania. Testing was performed at the request of the April 4, 2016 United States Environmental Protection Agency (USEPA) Coke Information Collection Request (ICR), as detailed in Enclosure 2.

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

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

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

HAP Metals (and CAS No.'s)

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

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

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

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

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

Speciated Volatile Organic Compounds

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

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

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

2 COMPANY AND TESTING FIRM INFORMATION

Company Contact	Testing Contact
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3 ANALYTICAL LABORATORY INFORMATION

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

USEPA Method 5/202	USEPA 5/29, 0010-23, 315, 0031 and 316
Montrose Air Quality Services, LLC. Ms. Erin Houpt 1050 William Pitt Way Pittsburgh, Pennsylvania 15238 (412) 826-3636 – Telephone ehoupt@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

USEPA Method 15	Water Samples
Montrose Air Quality Services, LLC. Mr. Frank Barton 1050 William Pitt Way Pittsburgh, Pennsylvania 15238 (412) 826-3636 – Telephone fbarton@montrose-env.com PA Lab Registration #02-04775	Test America Ms. Courtney Adkins 5815 Middlebrook Pike Knoxville, Tennessee 37921 (865) 291-3000 –Telephone Courtney.Adkins@testamericainc.com

4 TEST DATES AND PERSONNEL INFORMATION

Testing was performed October 25 – November 2, 2016. Key personnel involved in the test include:

Organization	Personnel	Responsibility
ArcelorMittal Monessen	Ms. Traci Self	Client Representative – Liaison to Test Company
Montrose Air Quality Services	Mr. Josh Varner, QSTI, Client Project Manager	Client Project Manager, Field Crew Test Leader, CEMS Operator, Report Writer
	Mr. William P. Cowell, QSTI, Client Project Manager	Method 320 Operator
	Mr. Frank M. Barton, Field Project Manager	Method 15 Project Operator
	Mr. Christopher Burkovich, Technician	Method 9 Observer
	Mr. Brandon Peyton, District Manager	Stack Tester, Sample Method Recovery
	Mr. Colin Oakes, Client Project	Stack Tester, Sample Method Recovery
	Mr. Zach Lefever, Technician	Stack Tester
	Mr. Johngbum Lee, 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.

The hot coke from the pushing car is carried to the quench tower, where it is sprayed with recycled water. The quenching lasts for approximately 5 minutes, before the coke can be taken to the screening station. A series of baffles are in place to remove coarse dust and mitigate emissions. Captured quench tower water is collected, transferred to several sumps and pits, where it is recycled for future spraying operations.

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

During the Method 0031, a condensate site field blank was collected. The results of the condensate site field blank showed an elevated toluene presence of very high magnitude (24,000 micrograms/liter). It is believed the deionized water in the field cleanup area was exposed to

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

USEPA was pre-notified of and agreed to non-isokinetic testing to be conducted on one-half of the quench tower using twelve total traverse points from four equal distance ports located only on one side of the quench tower per USEPA September 13, 2016 "Frequently Asked Questions (FAQs) and Responses for Coke Ovens Information Collection Request (ICR)," as noted in questions 13, 17 and 26. A copy of the USEPA September 13, 2016 FAQs and Responses that includes the questions and responses to 13, 17 and 26 is attached to this report. A temporary platform had to be erected on the west side of the quench tower to add four ports to conduct the ICR testing. USEPA ICR testing was required to be conducted above the last baffle, which did not allow for a suitable test location that meets minimum USEPA Method 1 upstream and downstream disturbance dimension requirements. USEPA was pre-notified of the unique circumstances associated with quench towers that commonly have the particulate removing baffles installed near the top of the quench tower. USEPA agreed to this ICR testing using non-standard test methods to be conducted at twelve points, recognizing the testing location did not meet minimum upstream and downstream disturbance requirements of USEPA Method 1.

Additionally, isokinetic testing is not believed to be possible at a Quench Tower due to the flow dynamics of the process. When steam is first sprayed onto the hot coke car, an initial higher velocity rush of air/steam is emitted. Testing began at the start of the quench and the initial (high) velocity point were measured and recorded with pitot tube static pressure readings as required. As the coke is cooled during the normal quench cycle duration of five minutes, the non-steady steam

flow velocity decreases from the initial high value to zero. Following the standard USEPA Method 2 pressure reading frequency requirements, the normal quench cycle duration was not long enough to collect subsequent readings at the standard frequency that would have recorded lower values than the initial reading. Applying the initial high velocity reading to the entire quench cycle, per the test methods, would be technically flawed and result in a very high biased and inaccurate flow calculations that do not take into account the observed decreasing velocity over the entire quench cycle that lasted five minutes. Unlike other sources that have a steady fan induced air flow, the non-steady air flow from the quench tower originates from the thermal buoyancy from the convective heat transfer from the water being applied to the hot coke which decreases from the start to the end of the coke quenching batch process.

Based on the inability to use standard USEPA testing methodologies for quench tower testing that provided non-standard results derived from non-isokinetic sampling, known high bias flows and the use of non-standard USEPA Method 1 upstream and downstream flow measurement testing methods, as disclosed to and accepted by USEPA in advance of the testing, this report includes the individual constituent results expressed in concentrations only since accurate mass calculations are not possible due to inaccurate flow calculations.

A cyclonic flow check could not be performed due to safety considerations and was acknowledged by USEPA's September 13, 2016 FAQs and Response to question 13. Personnel are not allowed to be on top of the quench tower during a quench due to safety concerns of steam and scalding risks, and no flow occurs in between quench cycles when personnel have safe access to the top of the tower.

Run 2 of Method 0010-23 was voided due to a failed leak check. The sample was not collected, and a fourth run conducted. Because testing of Method 315 was to be conducted simultaneously, that methods run was also discarded and a fourth run was conducted alongside the Method 0010-23 train.

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. Due to safety restrictions, a cyclonic flow check was not able to be conducted. Figure 2 shows a stack sampling schematic and sample point location.

6.3 Gas Flow and Temperature Measurements – USEPA Method 2

The gas flow rate and temperature profiles for the gas stream were measured by conducting simultaneous velocity and temperature traverses during each sampling run. Gas velocity head was measured with a calibrated Type S Pitot tube that was connected to a digital low-flow manometer. The static pressure was measured using the same Pitot tube and manometer. A Chrome-Alumel thermocouple attached to a digital indicator was used to measure the gas temperature at each of the traverse points. The gas flow and temperature measurements followed the principles of USEPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube).*

6.4 Moisture Content Sampling – USEPA Method 4

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

6.5 Particulate Emissions (FPM and CPM) – USEPA Methods 5 and 202

In lieu of $PM_{2.5}$ testing by Method 201A and 202, total particulate matter (TPM), which includes filterable particulate matter (FPM) and condensable particulate matter (CPM), was determined in accordance with USEPA Method 5, *Determination of Particulate Emissions from Stationary Sources* and USEPA Method 202, *Determination of Condensable Particulate Emissions from Stationary Sources.*

For this test:

- Filterable Particulate matter (FPM) = Method 5 filter + acetone wash
- Condensable Particulate matter (CPM) = Method 202 condensable rinses
- Total PM = FPM + CPM

6.5.1 Sampling Train Setup and Operation

Prior to sampling, all glassware was cleaned with soap and water, rinsed with tap water, deionized (DI) water, acetone, and finally hexane. After cleaning, the glassware was baked at 300°C for at least 6 hours. Following baking, the glassware was rinsed with DI water, distilled ultra-filtered water conforming to American Society for Testing and Materials (ASTM) D1193-06, Type 1. A clean set of glassware was utilized for each run whenever feasible.

The sampling apparatus contained a borosilicate glass-lined temperature-controlled (248°F ± 25°F) 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 high efficiency quartz filter supported in a glass-filter holder inside an oven heated to maintain the exit gas temperature at 248°F ± 25°F. The exit of the filter holder was connected to a USEPA Method 23 type condenser, a dropout Impinger or flask, a full-sized modified Greenburg-Smith Impinger, a Pall corporation Zefluor™ PTFE 50 millimeter (mm) membrane disc filter supported in a glass-filter holder containing a thermocouple. The sample train was then followed with a moisture trap consisting of a modified Greenburg-Smith Impinger containing 100 milliliters (ml) of water and an Impinger containing a known quantity 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 critical orifice procedures detailed in Section 16.2 of 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). Once an acceptable leak check 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. The sampling train was operated at an isokinetic rate with an isokinetic variation greater than 90% and less than 110% (see the non-isokinetic discussion in Section 6.1).

Each test run was at least 120 minutes in duration and had a minimum sample volume of 50 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.

6.5.2 Sample Recovery and Analysis

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

The USEPA Method 5 acetone rinse (Container 2) consisted of the nozzle, probe liner and front half of the filter holder rinses. This front-half rinse was evaporated to dryness in a glass 250 ml pre-weighed beaker, desiccated, and weighed to a constant weight. The total FPM catch is the sum of the front-half sample train acetone rinse plus the filter catch. Acetone rinses were performed a minimum of 3 times; the total rinse volume was a minimum of 30 ml/foot or 200 ml, whichever was greater.

Because water knockout was present prior to the CPM filter, the post-test pressurized nitrogen purge procedures in Section 8.5.3.1 of Method 202 were performed. After the post leak check, the Impinger train was lowered to the sample recovery area as quickly as feasible. The contents of the knockout Impinger were transferred into Impinger 2. The tip of the Impinger extended below the water level at least 1 centimeter. The inlet of the condenser was connected to the purge apparatus utilizing a leak-free connection. The purge apparatus consisted of an ultra-high purity (UHP) nitrogen cylinder, dual stage regulator, 47 mm glass fiber filter, and a calibrated rotometer. Impingers 3 and 4 were disconnected to allow for recovery of the moisture portion of the sampling train. The purge of the sample train had UHP nitrogen flowing at 14-20 liters per minute (lpm) through Impingers 1 and 2 and the CPM filter. During the purge the condenser had water circulating to maintain the CPM outlet temperature below 85°F. This temperature was recorded

every 15 minutes during the purge procedure along with nitrogen flowrate. The sample trains were purged for 60 minutes.

At the conclusion of the purge, the contents of Impingers 1 and 2 were transferred to a graduated cylinder and the volume was recorded, then transferred to a labeled glass sample bottle. The back-half of the filterable PM filter holder, the condenser, Impingers 1 and 2, 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 polyethylene (HDPE) Petri dish, labeled, and stored for transportation to the lab. In the lab, the CPM filter was transferred to a 50-ml extraction tube, where 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 also 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, and 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 twice 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, 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 to a pH of approximately 7.0 as indicated by the 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 Teflon® beaker or 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 then transferred to a tared Teflon® beaker or 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 H2O blank, and 200 ml hexane. Additionally, a single field train blank was prepared and analyzed according to Method 202 even though the glassware was baked. Laboratory results may be found in Appendix C.

Emissions were reported in grains per DSCF gr/DSCF and mg/dscm.

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% (see the non-isokinetic discussion in Section 6.1). 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.

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

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% (see the non-isokinetic discussion in Section 6.1). 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*, but substituting the collection reagent from methylene chloride to toluene. USEPA Method 5 was also run concurrent with this method, but because separate USEPA Method 5/29 and 5/202 samples were 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, as measured by an in-line thermocouple. 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% (see the non-isokinetic discussion in Section 6.1). 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 quench tower.

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 D. 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 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 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 Formaldehyde Emissions – USEPA Method 316

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

6.9.1 Sampling Train Setup and Operation

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

6.9.2 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% (see the non-isokinetic discussion in Section 6.1). Gaseous and particulate pollutants were withdrawn isokinetically from the source and collected in high purity water, as qualified by the non-isokinetic discussion in Section 6.1. At the conclusion of each test run, the sample train was cooled sufficiently, utilizing ambient air or ice, to allow the nozzle to be plugged with the rubber septum. The sampling train was leak-checked at a vacuum equal to or greater than the maximum value reached during sampling. Each test run was 120 minutes in duration and collected a minimum of 35 dry standard cubic feet. Three test runs were performed at the Quench Tower.

6.9.3 Sample Recovery

Container 1 – Probe and Impinger Catches. All surfaces to which the sample was exposed (including the probe nozzle, probe fitting, probe liner, first three impingers, and impinger

connectors) were rinsed with up to 400 mL of water and added to Container #1.Then, using a graduated cylinder, the volume of the solution in the first three impingers was measured to the nearest 0.5g, and recorded. The combined impinger solution from the graduated cylinder was transferred the same storage container as the water rinse. The container was put on ice during the entire time from collection until shipment to lab.

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

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

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

6.10 Speciated Volatile Organic HAPs – SW-846 Method 0031

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

6.10.1 Testing Procedures

Method 0031 employs a sampling module, a glass lined heated probe, and meter box to withdraw a nominal 20 liter sample of effluent gas containing volatile organic compounds from a stationary source at a flow rate of 0.5 L/min, using a glass-lined probe heated to 130 ± 5°C and a sampling method for volatile organic compounds (SMVOC) train. The gas stream is cooled to 20°C by passage through a water-cooled condenser and volatile organic compounds are collected on a set of sorbent traps (Tenax®-GC/Tenax®- GC/Anasorb®-747). Liquid condensate was collected in an impinger placed between the two Tenax®- GC traps and the Anasorb®-747 trap. The first and second traps contained 1.6 g of Tenax®-GC each and the third trap (back trap) contained 5.0 g of Anasorb®-747. 3 sets of traps and condensate were collected every 40 minutes of sampling time, with each set collecting approximately 20 liters of sample. A leak check of the system was performed prior to starting with an acceptable leak rate of 4% of the sample rate allowed. The probe was placed at a centrally located point in the quench tower. Flows and moistures were run

concurrently in a separate train to determine mass emission rates. A post-test leak check was performed at the highest recordable vacuum during the test.

6.10.2 Sample Recovery

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

6.11 Determination of Gaseous Emissions (Continuous Emissions Monitoring)

6.11.1 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.

6.11.2 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}) basis.

6.11.3 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.

6.11.4 Determination of SO_2 Emissions – USEPA Method 6C

The principles of USEPA Method 6C, *Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure),* were used for this test program. A gas sample was delivered to a Western Research 922 ultraviolet SO_2 analyzer. Testing of USEPA Method 6C was done concurrently with USEPA Method 15 testing for H_2S.

6.11.5 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.

6.11.6 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.

6.12 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 measurements. Laboratory results of these tests are provided in Appendix C. Emissions are reported on a ppm_v basis.

6.13 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.

6.13.1 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.

6.13.2 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.

6.14 Opacity and Visual Emissions – USEPA Methods 9 and 303

USEPA Method 9, *Visual Determination of the Opacity of Emissions From Stationary Sources,* was used to opacity coming from the exhaust quench tower during PM testing events. A certified observer recorded readings at 15 second intervals for the duration of the PM testing. USEPA Method 303, *Determination of Visible Emissions From By-Product Coke Oven Batteries*, was used to quantify visual emissions during PM testing events. The plant records VE emissions as part of their regular monitoring, and provided the relevant reports that occurred during the PM testing events. Results are reported as average % opacity observed during each run for opacity. VE observations are included in the Method 5/29 section of Appendix B, but are not also included in the report tables.

6.15 Water Sampling

As part of the ICR, during Quench Testing, simultaneous water samples were collected. Water samples were collected by Montrose personnel, placed on ice, and sent to Test America for analysis for the following analysis: cyanides, fluorides and chlorides, sulfides, total dissolved solids, selected volatile organic compounds, PCDD-PCDF, PAHs and selected semi-volatile organic compounds, and total metals. Three sets of water samples were collected in triplicate, and matched up to the appropriate air sampling method for collection times. The test runs were spaced out so that the first and last runs were greater than 20 quenches as required by the ICR. Collection of the water samples occurred in a trough that funneled the quench car run-off, and collected at a point just before makeup water was added to the runoff. Lab results are included as a CD insert to Appendix C due to the size of the laboratory reports.

6.16 Quality Assurance/Quality Control

The following field equipment calibrations are contained in Appendix D:

- Pitot and Thermocouple
- Nozzle
- Dry gas meter and orifice
- Interference data
- NOx converter check
- Calibration gas certificates

- USEPA Method 205 verification
- USEPA Method 320 QA checks
- Qualified Source Testing Individual (QSTI) certifications
- Opacity Observer Certification

6.17 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 the Quench Tower are contained in the following tables:

Table 1 – Total Particulate Matter Test Results
Table 2 – Filterable Particulate Matter Test Results (Opacity and VE included)
Table 3 – Metal Test Results
Table 4 –Dioxin/Furan Test Results
Table 5 – Semi-Volatile Organic Test Results
Table 6 – Toluene Soluble Organic Test Results
Table 7 – Formaldehyde Test Results
Table 8 – Speciated Volatile Organic Compounds
Table 9 – Gaseous Emissions Test Results
Table 10 – Acidic Gas Emission Test Results
Table 11 – Quench Tower Water Samples
Table 12 – Static Process Data (not test run specific)
Table 13 – Table Nomenclature.

8 CONCLUSION

The ICR test program has been conducted for ArcelorMittal Monessen LLC on the Quench Tower at their Monessen Coke Plant on October 25-November 2, 2016. Test results represent data that is considered to be representative of the emissions 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.ca

MAXXAM ANALYTICS
6740 Campobello Rd
Mississauga, ON L5N 2L8

Office 905 817 5700
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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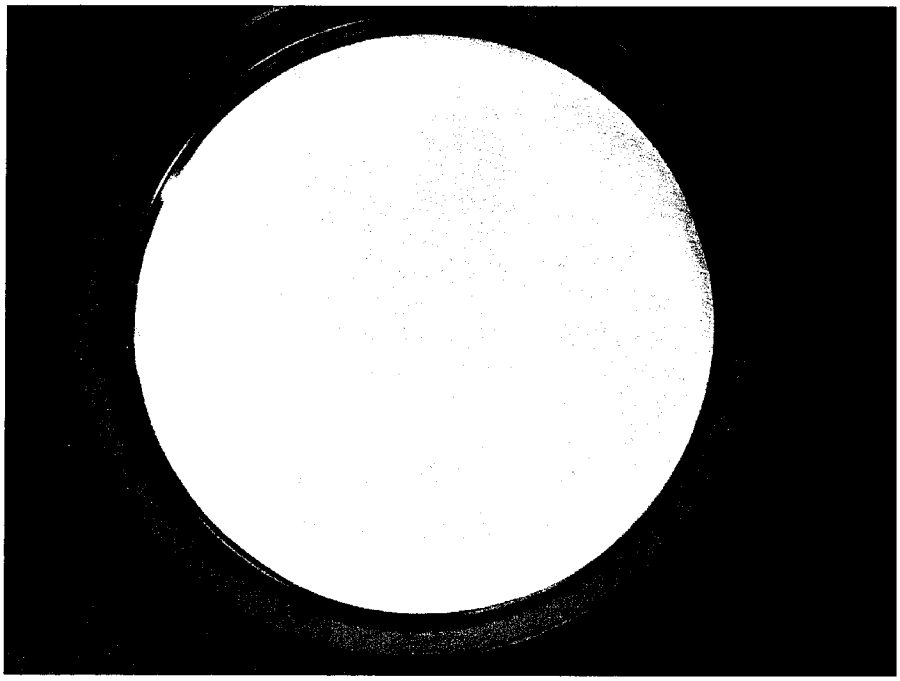

Figure 1 Method 315 Filter

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

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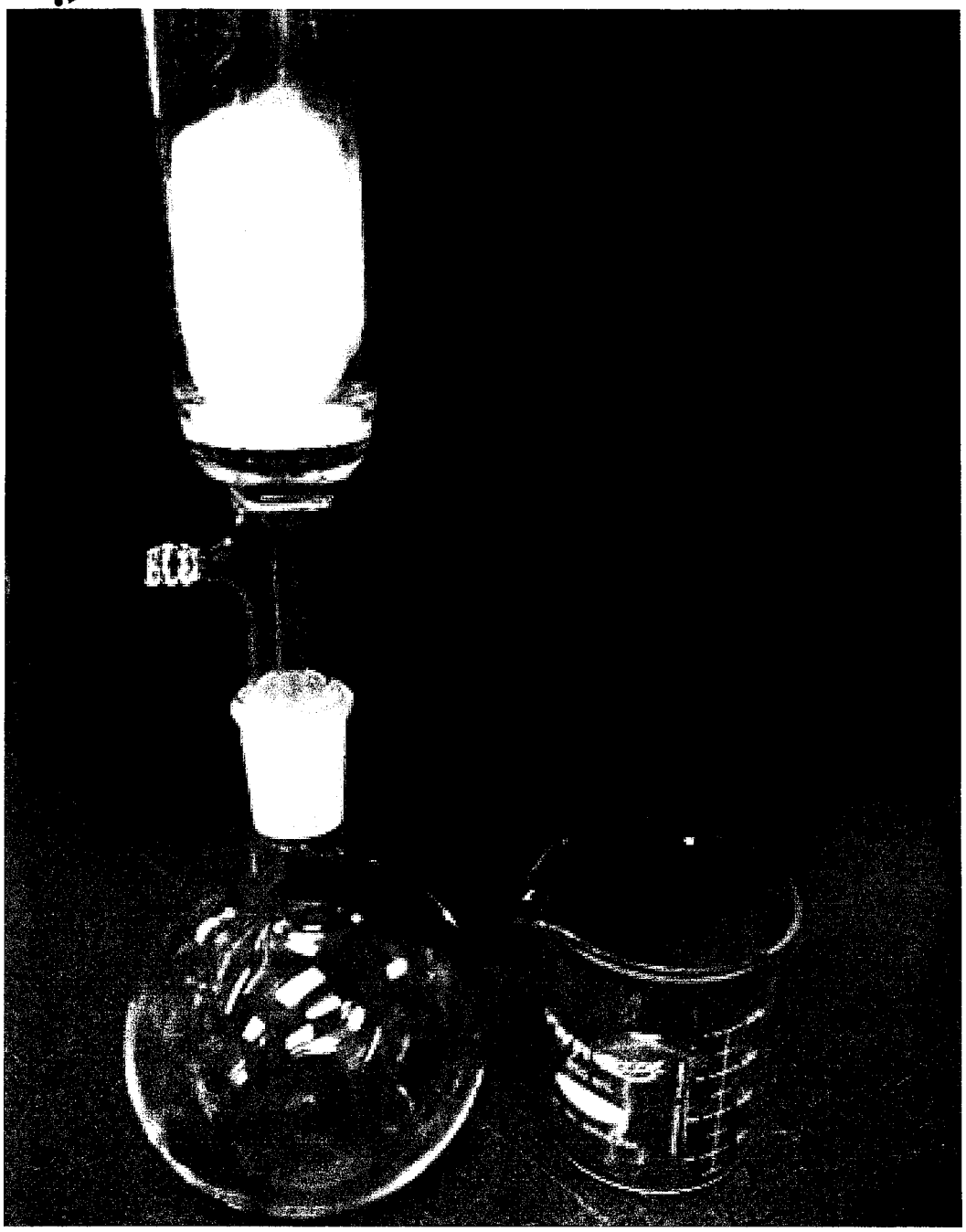
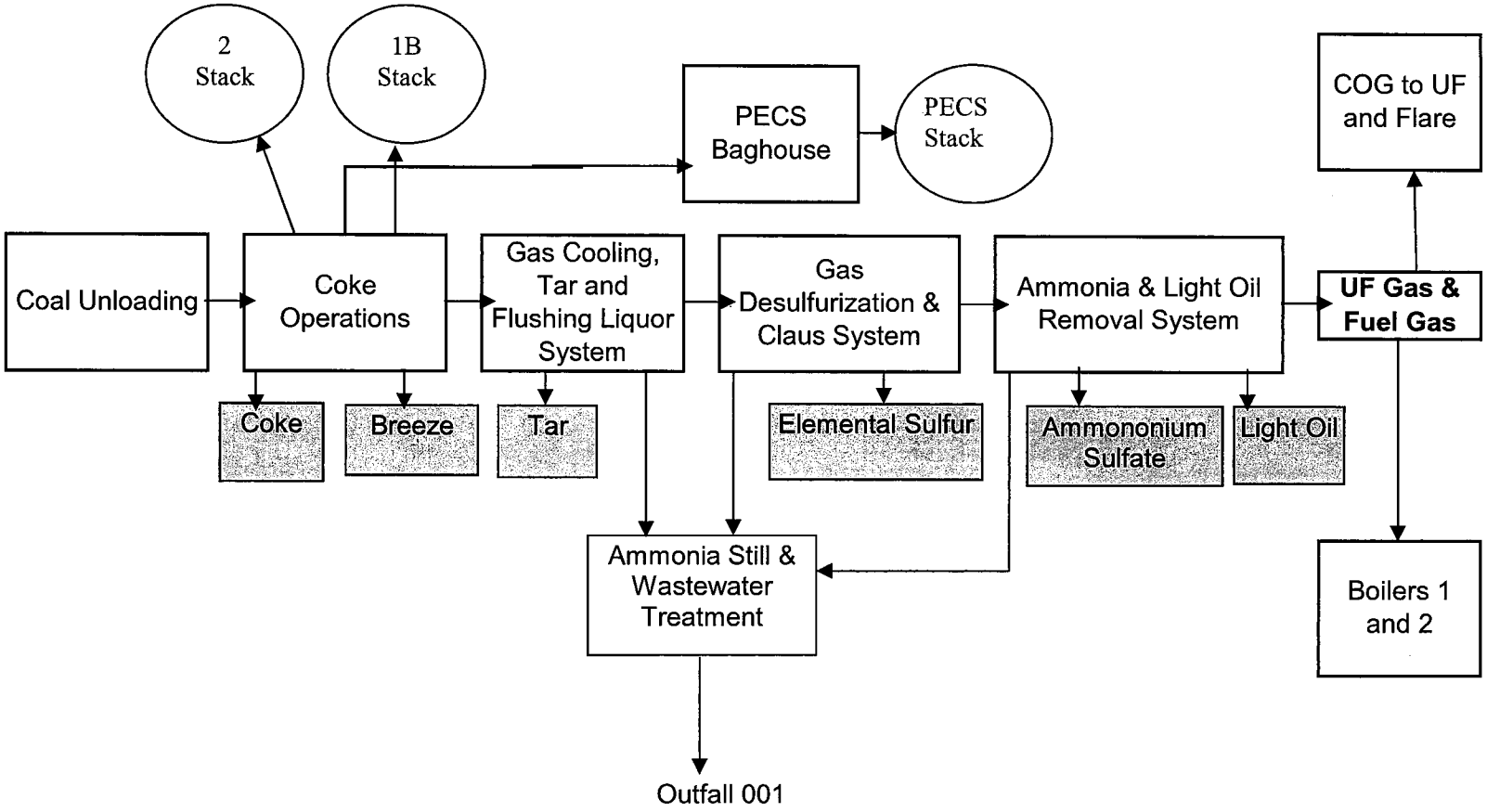


Figure 2 Filtration Apparatus

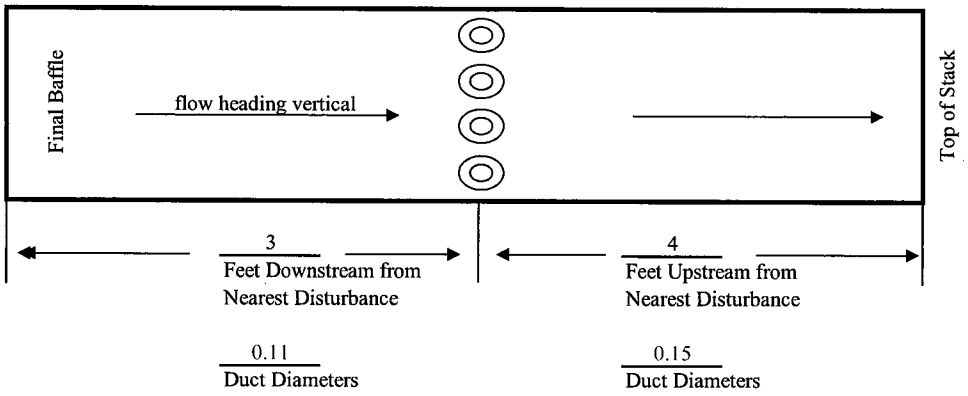
REPORT – FIGURES

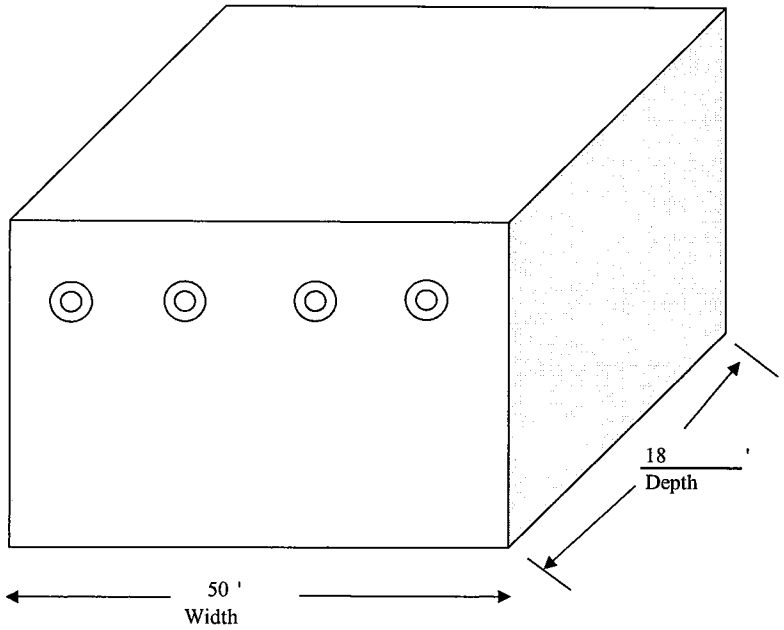


MONTROSE AIR QUALITY SERVICES

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

AIR/COMPLIANCE CONSULTANTS, INC.
USEPA METHOD 1 DATA SHEET





Depth	18 feet
Width	50 feet
De	26.5 feet

Ports	Point Number	Method 1 Value (inches)
A-D	1	18.0
	2	54.0
	3	90.0

MONTROSE AIR QUALITY SERVICES	QUENCH TOWER SCHEMATIC AND SAMPLING POINT LOCATION ARCELORMITTAL MONESSEN, MONESSEN COKE PLANT	Figure 2

REPORT – TABLES

Table 1. Total Particulate Matter Emission Test Results Summary, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		Oct. 27-28, 2016	Oct. 28, 2016	Oct. 31, 2016	
Start Time		9:17 PM	6:33 AM	9:37 AM	
End Time		5:50 AM	2:33 PM	7:15 PM	
Test Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)[1]	931,712	951,239	953,451	945,467
Flow Rate	(SCFM)[1]	768,554	777,155	779,111	774,940
Flow Rate	(DSCFM)[1]	613,334	630,280	630,201	624,605
Sample Volume	(DSCF)	51.290	53.234	53.837	52.787
Oxygen (O_2)	(dry volume %)	20.64	20.82	20.79	20.75
Carbon Dioxide (CO_2)	(dry volume %)	0.05	0.03	0.11	0.06
Water Vapor (H_2O)	(volume %)	20.20	18.90	19.11	19.40
Stack Temperature	(°F)	171.6	174.9	177.5	174.7
Percent of Isokinetic Sampling	(%) [2]	101.3	102.3	103.4	102.3
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		26	30	34	30
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)	301.6	348	394.4	348.0
COG generated during test	(mmscf)	5.76	5.39	6.49	5.88
COG burned in boilers during test	(mmscf)	1.53	1.43	1.72	1.56
COG burned in batteries during test	(mmscf)	3.34	3.13	3.77	3.41
Results					
Total Particulate Matter (Method 5 & 202)					
Total Particulate Mass (m_n)	(mg)	35.5	170.4	65.2	90.4
Emission Concentration	(mg/dscm)	24.4	113.1	42.8	60.1
Filterable Particulate Matter (Method 5)					
Total Particulate Mass (m_n)	(mg)	23.1	158.8	56.1	79.3
Emission Concentration	(mg/dscm)	15.9	105.3	36.8	52.7
Condensable Particulate Matter (Method 202)					
Condensable Inorganic Particulate (Uncorrected)	(mg)	7.56	9.40	8.11	8.36
Condensable Inorganic Concentration (Uncorrected)	(mg/dscm)	5.21	6.23	5.32	5.59
Condensable Organic Particulate (Uncorrected)	(mg)	5.40	2.85	1.55	3.27
Condensable Organic Concentration (Uncorrected)	(mg/dscm)	3.72	1.89	1.02	2.21
Blank Corrected Total Condensable Mass	(mg)	12.4	11.6	9.1	11.0
Emission Concentration	(mg/dscm)	8.51	7.73	5.94	7.39

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.

[2] See the non-isokinetic discussion in Section 6.1

Table 2. Filterable Particulate Matter Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		Oct. 27-28, 2016	October 28, 2016	Oct. 31, 2016	
Start Time		9:17 PM	6:33 AM	9:37 AM	
End Time		5:50 AM	2:33 PM	7:15 PM	
Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)[1]	972,268	957,215	961,005	963,496
Flow Rate	(SCFM)[1]	798,697	777,552	782,606	786,285
Flow Rate	(DSCFM)[1]	662,434	637,286	634,333	644,684
Sample Volume	(DSCF)	82.151	79.712	78.387	80.083
Oxygen	(dry volume %)	20.64	20.82	20.74	20.74
Carbon Dioxide	(dry volume %)	0.05	0.03	0.08	0.06
Water Vapor	(volume %)	17.06	18.04	18.95	18.02
Stack Temperature	(°F)	174.2	177.4	177.5	176.4
Percent of Isokinetic Sampling	(%) [2]	102.5	103.4	102.1	102.7
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		26	30	34	30
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)	301.6	348	394.4	348.0
COG generated during test	(mmscf)	5.76	5.39	6.49	5.88
COG burned in boilers during test	(mmscf)	1.53	1.43	1.72	1.56
COG burned in batteries during test	(mmscf)	3.34	3.13	3.77	3.41
Results					
Particulate Results -- by USEPA Method 5 front-half only					
Mass Collected	(mg)	252.0	40.9	514.0	269.0
Emission Concentration	(mg/dscm)	108.3	18.1	231.6	119.3
Opacity Results					
Average Opacity	(%)	0.00	0.00	0.00	0.00

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.

[2] See the non-isokinetic discussion in Section 6.1

Table 3. Metal Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		Oct. 27-28, 2016	Oct. 28, 2016	Oct. 31, 2016	
Start Time		9:17 PM	6:33 AM	9:37 AM	
End Time		5:50 AM	2:33 PM	7:15 PM	
Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)[1]	972,268	957,215	961,005	963,496
Flow Rate	(SCFM)[1]	798,697	777,552	782,606	786,285
Flow Rate	(DSCFM)[1]	662,434	637,286	634,333	644,684
Sample Volume	(DSCF)	82.15	79.71	78.39	80.08
Oxygen	(dry volume %)	20.64	20.82	20.74	20.74
Carbon Dioxide	(dry volume %)	0.05	0.03	0.08	0.06
Water Vapor	(volume %)	17.06	18.04	18.95	18.02
Stack Temperature	(°F)	174.2	177.4	177.5	176.4
Percent of Isokinetic Sampling	(%) [2]	102.5	103.4	102.1	102.7
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		26	30	34	30
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)	301.6	348	394.4	348.0
COG generated during test	(mmscf)	5.76	5.39	6.49	5.88
COG burned in boilers during test	(mmscf)	1.53	1.43	1.72	1.56
COG burned in batteries during test	(mmscf)	3.34	3.13	3.77	3.41
Results					
Mercury					
Emission concentration (1B Fraction)	(mg/DSCM)	< 2.32E-05	< 1.33E-05	< 1.35E-05	< 1.67E-05
Emission concentration (2B Fraction)	(mg/DSCM)	< 1.12E-04	< 1.59E-04	< 1.58E-04	< 1.43E-04
Emission concentration (3B Fraction)	(mg/DSCM)	< 1.07E-05	< 1.02E-05	< 1.04E-05	< 1.04E-05
Emission concentration (3C Fraction)	(mg/DSCM)	2.67E-05	2.22E-05	1.94E-05	2.27E-05
Antimony					
Emission Concentration Front-Half	(mg/DSCM)	< 8.60E-04	< 8.86E-04	9.46E-04	< 8.97E-04
Emission Concentration Back-Half	(mg/DSCM)	< 1.72E-04	< 1.77E-04	< 1.80E-04	< 1.76E-04
Arsenic					
Emission Concentration Front-Half	(mg/DSCM)	8.00E-03	1.18E-02	1.22E-02	1.06E-02
Emission Concentration Back-Half	(mg/DSCM)	4.26E-04	4.12E-03	1.92E-03	2.16E-03
Beryllium					
Emission Concentration Front-Half	(mg/DSCM)	< 2.15E-04	< 2.22E-04	< 2.25E-04	< 2.21E-04
Emission Concentration Back-Half	(mg/DSCM)	< 4.30E-05	< 4.43E-05	< 4.51E-05	< 4.41E-05

Table 3. Metal Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Cadmium					
Emission Concentration Front-Half	(mg/DSCM)	< 2.15E-04	< 2.22E-04	< 2.25E-04	< 2.21E-04
Emission Concentration Back-Half	(mg/DSCM)	< 4.30E-05	< 4.43E-05	< 4.51E-05	< 4.41E-05
Chromium					
Emission Concentration Front-Half	(mg/DSCM)	6.53E-03	1.51E-03	1.76E-02	8.54E-03
Emission Concentration Back-Half	(mg/DSCM)	5.63E-02	1.11E-03	2.90E-03	2.01E-02
Cobalt					
Emission Concentration Front-Half	(mg/DSCM)	4.00E-04	2.35E-04	6.58E-04	4.31E-04
Emission Concentration Back-Half	(mg/DSCM)	9.33E-04	1.33E-04	9.46E-05	3.87E-04
Lead					
Emission Concentration Front-Half	(mg/DSCM)	4.60E-03	3.81E-03	4.01E-03	4.14E-03
Emission Concentration Back-Half	(mg/DSCM)	7.87E-04	3.41E-04	3.78E-04	5.02E-04
Manganese					
Emission Concentration Front-Half	(mg/DSCM)	5.42E-02	2.97E-03	2.14E-02	2.62E-02
Emission Concentration Back-Half	(mg/DSCM)	4.56E-02	5.85E-03	5.95E-02	3.70E-02
Nickel					
Emission Concentration Front-Half	(mg/DSCM)	4.99E-03	1.82E-03	1.45E-02	7.10E-03
Emission Concentration Back-Half	(mg/DSCM)	2.91E-02	1.13E-03	5.45E-03	1.19E-02
Selenium					
Emission Concentration Front-Half	(mg/DSCM)	< 2.15E-03	< 2.22E-03	< 2.25E-03	< 2.21E-03
Emission Concentration Back-Half	(mg/DSCM)	2.54E-03	1.55E-03	1.40E-03	1.83E-03

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.

[2] See the non-isokinetic discussion in Section 6.1

Table 4. Dioxin/Furan Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 3	Run 4	Average
Date		Oct. 27, 2016	Nov. 1, 2016	Nov. 1-2, 2016	
Start Time		3:29 AM	10:32 AM	11:41 PM	
End Time		4:40 PM	10:28 PM	1:03 PM	
Test Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)[1]	966,435	968,835	936,771	957,347
Flow Rate	(SCFM)[1]	780,523	784,756	765,950	777,076
Flow Rate	(DSCFM)[1]	655,517	673,374	640,871	656,587
Sample Volume	(DSCF)	159.4	161.7	156.4	159.2
Oxygen	(dry volume %)	20.42	20.82	20.69	20.64
Carbon Dioxide	(dry volume %)	0.06	0.16	0.11	0.11
Water Vapor	(volume %)	16.02	14.19	16.33	15.51
Stack Temperature	(°F)	176.7	178.4	172.4	175.8
Percent of Isokinetic Sampling	(%)[2]	98.4	97.2	98.8	98.1
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	48	45	46	46.3
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	2,431	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	556.8	522	533.6	537.5
COG generated during test	(mmscf)	8.89	8.04	9.01	8.65
COG burned in boilers during test	(mmscf)	2.36	2.14	2.39	2.30
COG burned in batteries during test	(mmscf)	5.16	4.67	5.23	5.02
Results					
Dioxins and Furans					
TEF Mass Collected	(ng)	< 0.019	< 0.016	< 0.016	< 0.017
TEF Emission Concentration	(ng/m^3)	< 0.004	< 0.003	< 0.004	< 0.004
2,3,7,8-Tetrachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 7.1E-07	< 7.4E-07	< 1.0E-06	< 8.3E-07
	(TEF µg/m^3)	< 7.1E-07	< 7.4E-07	< 1.0E-06	< 8.3E-07
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 1.2E-06	< 9.4E-07	< 9.5E-07	< 1.0E-06
	(TEF µg/m^3)	< 6.2E-07	< 4.7E-07	< 4.7E-07	< 5.2E-07
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 8.0E-07	< 7.0E-07	< 8.8E-07	< 7.9E-07
	(TEF µg/m^3)	< 8.0E-08	< 7.0E-08	< 8.8E-08	< 7.9E-08
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	2.4E-06	2.5E-06	< 8.8E-07	< 2.0E-06
	(TEF µg/m^3)	2.4E-07	2.5E-07	< 8.8E-08	< 2.0E-07
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	2.9E-06	3.6E-06	1.2E-06	2.6E-06
	(TEF µg/m^3)	2.9E-07	3.6E-07	1.2E-07	2.6E-07
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	6.4E-05	4.7E-05	1.1E-05	4.1E-05
	(TEF µg/m^3)	6.4E-07	4.7E-07	1.1E-07	4.1E-07
2,3,7,8-Tetrachlorodibenzofuran					
	(raw µg/m^3)	8.4E-06	1.6E-06	6.9E-06	5.6E-06
	(TEF µg/m^3)	6.4E-07	1.6E-07	6.9E-07	4.9E-07
1,2,3,7,8-Pentachlorodibenzofuran					
	(raw µg/m^3)	< 9.7E-07	< 9.6E-07	< 9.9E-07	< 9.8E-07
	(TEF µg/m^3)	< 4.9E-08	< 4.8E-08	< 5.0E-08	< 4.9E-08

Table 4. Dioxin/Furan Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 3		Run 4		Average
2,3,4,7,8-Pentachlorodibenzofuran									
	(raw μg/m^3)	<	9.7E-07	<	9.6E-07	<	9.9E-07	<	9.8E-07
	(TEF μg/m^3)	<	4.9E-07	<	4.8E-07	<	5.0E-07	<	4.9E-07
1,2,3,4,7,8-Hexachlorodibenzofuran									
	(raw μg/m^3)		1.7E-06	<	9.0E-07	<	8.6E-07	<	1.1E-06
	(TEF μg/m^3)		1.7E-07	<	9.0E-08	<	8.6E-08	<	1.1E-07
1,2,3,6,7,8-Hexachlorodibenzofuran									
	(raw μg/m^3)	<	6.4E-07	<	8.5E-07	<	8.4E-07	<	7.8E-07
	(TEF μg/m^3)	<	6.4E-08	<	8.5E-08	<	8.4E-08	<	7.8E-08
2,3,4,6,7,8-Hexachlorodibenzofuran									
	(raw μg/m^3)		8.6E-07	<	9.4E-07	<	9.0E-07	<	9.0E-07
	(TEF μg/m^3)		8.6E-08	<	9.4E-08	<	9.0E-08	<	9.0E-08
1,2,3,7,8,9-Hexachlorodibenzofuran									
	(raw μg/m^3)	<	7.3E-07	<	9.8E-07	<	9.5E-07	<	8.9E-07
	(TEF μg/m^3)	<	7.3E-08	<	9.8E-08	<	9.5E-08	<	8.9E-08
1,2,3,4,6,7,8-Heptachlorodibenzofuran									
	(raw μg/m^3)		4.4E-06		1.8E-06		8.8E-07		2.4E-06
	(TEF μg/m^3)		4.4E-08		1.8E-08		8.8E-09		2.4E-08
1,2,3,4,7,8,9-Heptachlorodibenzofuran									
	(raw μg/m^3)	<	8.6E-07	<	7.6E-07	<	7.0E-07	<	7.8E-07
	(TEF μg/m^3)	<	8.6E-09	<	7.6E-09	<	7.0E-09	<	7.8E-09

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.
[2] See the non-isokinetic discussion in Section 6.1

Table 5. Semi-Volatile Organic Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 3	Run 4	Average
Date		Oct. 27, 2016	Nov. 1, 2016	Nov. 1-2, 2016	
Start Time		3:29 AM	10:32 AM	11:41 PM	
End Time		4:40 PM	10:28 PM	1:03 PM	
Test Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)[1]	966,435	968,835	936,771	957,347
Flow Rate	(SCFM)[1]	780,523	784,756	765,950	777,076
Flow Rate	(DSCFM)[1]	655,517	673,374	640,871	656,587
Sample Volume	(DSCF)	159.4	161.7	156.4	159.2
Oxygen	(dry volume %)	20.42	20.82	20.69	20.64
Carbon Dioxide	(dry volume %)	0.06	0.16	0.11	0.11
Water Vapor	(volume %)	16.02	14.19	16.33	15.51
Stack Temperature	(°F)	176.7	178.4	172.4	175.8
Percent of Isokinetic Sampling	(%) [2]	98.4	97.2	98.8	98.1
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	48	45	46	46.3
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	2,431	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	556.8	522	533.6	537.5
COG generated during test	(mmscf)	8.89	8.04	9.01	8.65
COG burned in boilers during test	(mmscf)	2.36	2.14	2.39	2.30
COG burned in batteries during test	(mmscf)	5.16	4.67	5.23	5.02
Results					
Semi-Volatiles					
Acenaphthene					
Mass Collected	(µg)	30.0	36.0	24.0	30.0
Emission Concentration	(mg/m^3)	0.0066	0.0079	0.0054	0.0066
Acenaphthylene					
Mass Collected	(µg)	69.0	37.0	< 20.0	< 42.0
Emission Concentration	(mg/m^3)	0.0153	0.0081	< 0.0045	< 0.0093
Anthracene					
Mass Collected	(µg)	33.0	27.0	< 20.0	< 26.7
Emission Concentration	(mg/m^3)	0.0073	0.0059	< 0.0045	< 0.0059
Benz[a]anthracene					
Mass Collected	(µg)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0044	< 0.0044	< 0.0045	< 0.0044
Benzo[a]pyrene					
Mass Collected	(µg)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0044	< 0.0044	< 0.0045	< 0.0044
Benzo[b]fluoranthene					
Mass Collected	(µg)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0044	< 0.0044	< 0.0045	< 0.0044
Benzo[g,h,i]perylene					
Mass Collected	(µg)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0044	< 0.0044	< 0.0045	< 0.0044
Benzo[k]fluoranthene					
Mass Collected	(µg)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0044	< 0.0044	< 0.0045	< 0.0044

Table 5. Semi-Volatile Organic Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 3		Run 4		Average
Chrysene									
Mass Collected	(µg)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0044	<	0.0044	<	0.0045	<	0.0044
Dibenz[a,h]anthracene									
Mass Collected	(µg)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.00443	<	0.00437	<	0.00452	<	0.00444
Fluoranthene									
Mass Collected	(µg)		52.0		59.0		29.0		46.7
Emission Concentration	(mg/m^3)		0.012		0.013		0.007		0.010
Fluorene									
Mass Collected	(µg)		58.0		44.0		30.0		44.0
Emission Concentration	(mg/m^3)		0.013		0.010		0.007		0.010
Indeno (1,2,3-cd) pyrene									
Mass Collected	(µg)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0044	<	0.0044	<	0.0045	<	0.0044
Naphthalene									
Mass Collected	(µg)		228.0		137.0		126.0		163.7
Emission Concentration	(mg/m^3)		0.051		0.030		0.028		0.036
Phenanthrene									
Mass Collected	(µg)		156.0		148.0		77.0		127.0
Emission Concentration	(mg/m^3)		0.035		0.032		0.017		0.028
Perylene									
Mass Collected	(µg)	<	15.0	<	15.0	<	15.0	<	15.0
Emission Concentration	(mg/m^3)	<	0.0033	<	0.0033	<	0.0034	<	0.003
Pyrene									
Mass Collected	(µg)		46.0		41.0		25.0		37.3
Emission Concentration	(mg/m^3)		0.0102		0.0090		0.0056		0.0083

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.

[2] See the non-isokinetic discussion in Section 6.1

Table 6. Modified Method 315 Toluene Soluble Organics Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 3**	**Run 4**	**Average**
Date		Oct. 27, 2016	Nov. 1, 2016	Nov. 1-2, 2016	
Start Time		3:29 AM	10:32 AM	11:41 PM	
End Time		4:40 PM	10:28 PM	1:03 PM	
Sample Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)[1]	979,019	975,439	946,765	967,074
Flow Rate	(SCFM)[1]	788,074	790,070	774,869	784,338
Flow Rate	(DSCFM)[1]	602,820	644,504	628,699	625,341
Sample Volume	(DSCF)	77.2	85.1	81.4	81.2
Oxygen (O_2)	(dry volume %)	20.42	20.82	20.69	20.64
Carbon Dioxide (CO_2)	(dry volume %)	0.06	0.16	0.11	0.11
Water Vapor (H_2O)	(volume %)	23.51	18.42	18.86	20.27
Stack Temperature	(°F)	178.8	178.4	171.8	176.3
Percent of Isokinetic Sampling	(%) [2]	103.4	106.6	104.6	104.9
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	48	45	46	46
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	2,431	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	556.8	522	533.6	537.5
COG generated during test	(mmscf)	8.89	8.04	9.01	8.65
COG burned in boilers during test	(mmscf)	2.36	2.14	2.39	2.30
COG burned in batteries during test	(mmscf)	5.16	4.67	5.23	5.02
Results					
Toluene Soluble Organics [3]					
Blank Corrected Mass Collected	(mg)	9.46	10.11	6.16	8.57
Emission Concentration	(mg/dscm)	4.33	4.20	2.67	3.73

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.

[2] See the non-isokinetc discussion in Section 6.1

[3] 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. Formaldehyde Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			**Run 1**	**Run 2**		**Run 3**		**Average**
Date			Oct. 25, 2016	Oct. 25-26, 2016		Oct. 26-27, 2016		
Start Time			9:10 AM	6:06 PM		5:28 PM		
End Time			5:32 PM	4:55 PM		1:23 AM		
Test Duration	(minutes)		120	120		120		
Flow Rate	(ACFM)[1]		908,708	992,640		1,001,390		967,580
Flow Rate	(SCFM)[1]		761,040	811,056		816,459		796,185
Flow Rate	(DSCFM)[1]		636,047	719,510		642,560		666,039
Sample Volume	(DSCF)		43.9	44.2		42.6		43.6
Oxygen	(dry volume %)		19.44	19.46		19.41		19.44
Carbon Dioxide	(dry volume %)		0.03	0.05		0.06		0.05
Water Vapor	(volume %)		16.42	11.29		21.30		16.34
Stack Temperature	(°F)		161.3	177.1		173.5		170.6
Percent of Isokinetic Sampling	(%) [2]		105.5	93.9		101.3		100.3
Process Data								
ID #'s of Ovens Pushed/Charged				See Appendix A				
# of Ovens Pushed during test			29	29		29		29
Average coking time per oven(s) tested	(hours)		16.19	16.19		16.19		16.19
Average temperature of coke walls	(°F)		2,432	2,433		2,432		2,432
Coal processed during testing	(tons/oven)		16.2	16.2		16.2		16.2
Coke produced during test period	(tons)		336.4	336.4		336.4		336.4
COG generated during test	(mmscf)		5.64	15.38		5.34		8.78
COG burned in boilers during test	(mmscf)		1.50	4.08		1.42		2.33
COG burned in batteries during test	(mmscf)		3.27	8.93		3.10		5.10
Results								
Formaldehyde								
Emission Mass	(mg)	<	0.012	0.034	<	0.011	<	0.019
Emission Concentration	(mg/DSCM)	<	0.010	0.027	<	0.009	<	0.015

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table.

[2] See the non-isokinetic discussion in Section 6.1

Table 8. Speciated Volatile Organic Compound Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		Oct. 25, 2016	Oct. 25-26, 2016	Oct. 26-27, 2016	
Start Time		9:10 AM	6:06 PM	5:28 PM	
End Time		5:32 PM	4:55 PM	1:23 AM	
Test Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)[1]	908,458	992,397	1,001,047	967,301
Flow Rate	(SCFM)[1]	760,831	810,857	816,179	795,956
Flow Rate	(DSCFM)[1]	636,920	720,351	643,713	666,995
VOST Sample Volume	(liters, dry standard)	60.92	59.98	59.84	60.25
Oxygen (O_2)	(dry volume %)	19.44	19.46	19.41	19.44
Carbon Dioxide (CO_2)	(dry volume %)	0.03	0.05	0.06	0.05
Water Vapor (H_2O)	(volume %)	16.29	11.16	21.13	16.19
Stack Temperature	(°F)	161.3	177.1	173.5	170.6
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		29	29	29	29
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,433	2,432	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	336.4	336.4	336.4	336.4
COG generated during test	(mmscf)	5.64	15.38	5.34	8.78
COG burned in boilers during test	(mmscf)	1.50	4.08	1.42	2.33
COG burned in batteries during test	(mmscf)	3.27	8.93	3.10	5.10
Semi-volatile Results					
Acrylonitrile (107-13-1)					
Emission Mass Collected	(µg)[2]	< 0.03	< 0.03	< 0.03	< 0.03
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00
Benzene					
Emission Mass Collected	(µg)[2]	1.90	0.27	1.15	1.11
Emission Concentration	(mg/DSCM)	0.03	0.00	0.02	0.02
Bromoform (75-25-2)					
Emission Mass Collected	(µg)[2]	< 0.01	< 0.01	< 0.01	< 0.01
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00
Bromomethane (74-83-9)					
Emission Mass Collected	(µg)[2]	< 0.02	< 0.02	< 0.02	< 0.02
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00
Carbon disulfide (75-15-0)					
Emission Mass Collected	(µg)[2]	1.45	< 0.76	< 0.03	< 0.74
Emission Concentration	(mg/DSCM)	0.02	< 0.01	< 0.00	< 0.01
Carbon tetrachloride (56-23-5)					
Emission Mass Collected	(µg)[2]	< 0.02	< 0.02	< 0.02	< 0.02
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00
Chlorobenzene (108-90-7)					
Emission Mass Collected	(µg)[2]	< 0.01	< 0.01	< 0.01	< 0.01
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00
Chloroethane (75-00-3)					
Emission Mass Collected	(µg)[2]	< 0.01	< 0.01	< 0.01	< 0.01
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00
Chloroform (67-66-3)					
Emission Mass Collected	(µg)[2]	< 0.01	< 0.01	< 0.01	< 0.01
Emission Concentration	(mg/DSCM)	< 0.00	< 0.00	< 0.00	< 0.00

Table 8. Speciated Volatile Organic Compound Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 2		Run 3		Average
Chloromethane (74-87-3)									
Emission Mass Collected	(µg)[2]		0.04	<	0.02	<	0.02	<	0.02
Emission Concentration	(mg/DSCM)		0.00	<	0.00	<	0.00	<	0.00
1,2-Dichloroethane (107-06-2)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
1,1-Dichloroethene (75-35-4)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
1,2-Dichloropropane (78-87-5)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Ethylbenzene (100-41-4)									
Emission Mass Collected	(µg)[2]		0.05	<	0.03	<	0.01	<	0.03
Emission Concentration	(mg/DSCM)		0.00	<	0.00	<	0.00	<	0.00
Iodomethane (74-88-4)									
Emission Mass Collected	(µg)[2]	<	0.02	<	0.02	<	0.02	<	0.02
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Methylene chloride (75-09-2)									
Emission Mass Collected	(µg)[2]	<	0.03	<	0.04		0.05	<	0.04
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00		0.00	<	0.00
Styrene (100-42-5)									
Emission Mass Collected	(µg)[2]		0.11	<	0.02	<	0.01	<	0.05
Emission Concentration	(mg/DSCM)		0.00	<	0.00	<	0.00	<	0.00
1,1,2,2-Tetrachloroethane (79-34-5)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Tetrachloroethene (127-18-4)									
Emission Mass Collected	(µg)[2]	<	0.02	<	0.02	<	0.02	<	0.02
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Toluene (108-88-3)									
Emission Mass Collected	(µg)[2]		0.4		0.2		0.1		0.24
Emission Concentration	(mg/DSCM)		0.01		0.00		0.00		0.00
1,1,1-Trichloroethane (71-55-6)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
1,1,2-Trichloroethane (79-00-5)									
Emission Mass Collected	(µg)[2]	<	0.02	<	0.02	<	0.02	<	0.02
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Trichloroethene (79-01-6)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Vinyl chloride (75-01-4)									
Emission Mass Collected	(µg)[2]	<	0.01	<	0.01	<	0.01	<	0.01
Emission Concentration	(mg/DSCM)	<	0.00	<	0.00	<	0.00	<	0.00
Xylenes (total) (1330-20-7)									
Emission Mass Collected	(µg)[2]		0.42	<	0.11	<	0.03	<	0.19
Emission Concentration	(mg/DSCM)		0.01	<	0.00	<	0.00	<	0.00

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table

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

Table 9. Gaseous Emissions Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		11/01/16	11/01/16	11/02/17	
Start Time		8:51 AM	1:30 PM	7:43 AM	
End Time		12:56 PM	5:44 PM	12:12 PM	
Test Duration	(minutes)	60	60	60	
Flow Rate	(ACFM)[1]	968,900	968,990	936,499	958,130
Flow Rate	(SCFM)[1]	784,808	784,881	765,727	778,472
Flow Rate	(DSCFM)[1]	674,180	674,242	641,518	663,313
Sample Volume	(DSCF)	162.9	162.9	157.7	161.2
Oxygen (O_2)	(dry volume %)	20.77	20.71	20.78	20.75
Carbon Dioxide (CO_2)	(dry volume %)	0.07	0.05	0.11	0.08
Water Vapor (H_2O)	(volume %)	14.10	14.10	16.22	14.80
Stack Temperature	(°F)	178.4	178.4	172.4	176.4
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	15	15	15	15.0
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,432	2,431	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	174	174	174	174.0
COG generated during test	(mmscf)	2.75	2.85	3.02	2.88
COG burned in boilers during test	(mmscf)	0.73	0.76	0.80	0.76
COG burned in batteries during test	(mmscf)	1.60	1.66	1.75	1.67
Results					
Carbon Monoxide (CO)					
Emission Concentration	(ppm_{dv})	91.9	140.1	118.5	116.80
Sulfur Dioxide (SO_2)					
Emission Concentration	(ppm_{dv})	2.89	5.11	3.98	3.99
Hydrogen Sulfide (H_2S)					
Emission Concentration	(ppm_{wv})	< 0.50	< 0.50	< 0.50	< 0.50
Emission Concentration	(ppm_{dv})	< 0.58	< 0.58	< 0.60	< 0.59
Carbon Dioxide (CO2)					
Emission Concentration	(ppm_{dv})	709	504	1,134	782

CEM results have been bias calibration corrected.

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table

Table 10. Acidic Gas Emissions Test Results, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		Nov. 1, 2016	Nov. 2, 2016	Nov. 2, 2016	
Start Time		11:13 AM	7:43 AM	10:56 AM	
End Time		2:44 PM	10:48 AM	2:54 PM	
Test Duration	(minutes)	60	60	60	
Flow Rate	(ACFM)[1]	968,633	936,659	936,564	947,285
Flow Rate	(SCFM)[1]	784,592	765,858	765,780	772,076
Flow Rate	(DSCFM)[1]	673,994	641,627	641,562	652,395
Sample Volume	(DSCF)	162.9	157.7	157.7	159.4
Oxygen (O_2)	(dry volume %)	20.80	20.54	20.68	20.68
Carbon Dioxide (CO_2)	(dry volume %)	0.17	0.10	0.11	0.13
Water Vapor (H_2O)	(volume %)	14.10	16.22	16.22	15.51
Stack Temperature	(°F)	178.4	172.4	172.4	174.4
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	12	12	12	12.0
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,431	2,431	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	139.2	139.2	139.2	139.2
COG generated during test	(mmscf)	2.37	2.08	2.67	2.37
COG burned in boilers during test	(mmscf)	0.63	0.55	0.71	0.63
COG burned in batteries during test	(mmscf)	1.38	1.21	1.55	1.38
Results					
Hydrogen Chloride (HCl)					
Emission Concentration	(ppm_{wv})	< 0.22	< 0.22	< 0.22	< 0.22
Emission Concentration	(ppm_{dv})	< 0.26	< 0.27	< 0.27	< 0.27
Emission Concentration	(mg/dscm)	< 0.43	< 0.44	< 0.44	< 0.43
Hydrogen Flouride (HF)					
Emission Concentration	(ppm_{wv})	< 0.054	< 0.054	< 0.054	< 0.054
Emission Concentration	(ppm_{dv})	< 0.063	< 0.064	< 0.064	< 0.064
Emission Concentration	(mg/dscm)	< 0.056	< 0.057	< 0.057	< 0.057
Hydrogen Cyanide (HCN)					
Emission Concentration	(ppm_{wv})	1.17	0.83	0.73	0.91
Emission Concentration	(ppm_{dv})	1.36	0.99	0.87	1.08
Emission Concentration	(mg/dscm)	1.64	1.20	1.05	1.30

[1] Values shown are based on measurements taken only at the start of a quench and should be considered maximum velocity readings. Due to the process having constantly decreasing velocities over time, however, emission rates were not calculated or presented in this table

Table 11. Quench Tower Water Analyses Test Results, Quench Tower
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Pollutant		Run 1	Run 2	Run 3	Average
Cyanide, Total (µg/mL)		< 2.93	< 1.73	2.40	< 2.36
Chloride (mg/L) *		31.3	30.8	NA	31.0
Fluoride (mg/L) *		1.82	1.77	NA	1.80
Sulfides (mg/L)		1.63	1.57	1.07	1.42
Total Dissolved Solids (mg/L) *		467	467	NA	467
VOCs (µg/L)	1, 1-Dichloroethene	< 0.33	< 0.33	< 0.33	< 0.33
	Acrylonitrile	< 7.00	< 7.00	< 7.00	< 7.00
	Benzene	< 0.39	0.54	0.37	< 0.44
	Bromoform	< 2.50	< 2.50	< 2.50	< 2.50
	Bromomethane	< 0.70	< 0.93	< 0.70	< 0.78
	Carbon disulfide	< 0.33	< 0.39	< 0.20	< 0.31
	Carbon tetrachloride	< 0.27	< 0.27	< 0.27	< 0.27
	Chlorobenzene	< 0.22	< 0.33	< 0.20	< 0.25
	Chloroethane	< 0.65	< 0.68	< 0.65	< 0.66
	Chloroform	< 0.18	< 0.31	< 0.18	< 0.23
	Chloromethane	< 2.00	< 2.00	< 2.00	< 2.00
	1, 2-Dichloroethane	< 1.00	< 1.00	< 1.00	< 1.00
	1, 2-Dichloropropane	< 0.24	< 0.30	< 0.24	< 0.26
	Ethylbenzene	0.65	1.22	1.20	1.02
	Iodomethane	< 5.00	< 5.00	< 5.00	< 5.00
	Methylene Chloride	1.30	1.60	1.30	1.40
	Styrene	< 0.20	< 0.28	< 0.20	< 0.23
	1,1,2,2-Tetrachloroethane	< 0.41	< 0.41	< 0.41	< 0.41
	Tetrachloroethene	< 0.27	< 0.37	< 0.27	< 0.30
	Toluene	3300	5100	4833	4411
	1,1,1-Trichloroethane	< 0.35	< 0.35	< 0.35	< 0.35
	1,1,2-Trichloroethane	< 0.40	< 0.40	< 0.40	< 0.40
	Trichloroethene	< 0.27	< 0.36	< 0.27	< 0.30
	Vinyl chloride	< 2.00	< 2.00	< 2.00	< 2.00
	Xylenes (total)	< 1.07	< 1.33	< 1.10	< 1.17

Table 11. Quench Tower Water Analyses Test Results, Quench Tower
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Pollutant		Run 1	Run 2	Run 3	Average
PCDD-PCDF (pg/L)	2,3,7,8-TCDD	< 1.43	< 2.10	< 1.57	< 1.70
	1,2,3,7,8-PeCDD	< 1.10	< 1.40	< 1.10	< 1.20
	1,2,3,4,7,8-HxCDD	6.97	8.67	7.30	7.64
	1,2,3,6,7,8HxCDD	35.7	43.7	39.0	39.4
	1,2,3,7,8,9-HxCDD	55.7	68.0	59.3	61.0
	1,2,3,4,6,7,8-HpCDD	1233	1533	1333	1367
	2,3,7,8-TCDF	< 0.96	< 1.27	< 0.99	< 1.07
	1,2,3,7,8-PeCDF	< 0.80	< 1.06	< 0.83	< 0.90
	2,3,4,7,8-PeCDF	< 0.74	< 0.96	< 0.79	< 0.83
	1,2,3,4,7,8-HxCDF	< 0.55	< 0.76	< 0.60	< 0.63
	1,2,3,6,7,8-HxCDF	< 0.57	< 0.74	< 0.58	< 0.63
	2,3,4,6,7,8-HxCDF	< 0.56	< 0.78	< 0.61	< 0.65
	1,2,3,7,8,9-HxCDF	< 0.72	< 0.97	< 0.75	< 0.81
	1,2,3,4,6,7,8-HpCDF	19.7	23.7	21.3	21.6
	1,2,3,4,7,8,9-HpCDF	< 2.30	< 2.17	< 1.90	< 2.12
PAHs and Selected SVOCs (ng/L)	Acenaphthene	450	470	470	463
	Acenaphthylene	1333	1367	1433	1378
	Anthracene	2033	2000	2133	2056
	Benzo (a) anthracene	5400	4500	5300	5067
	Benzo (b) fluoranthene	7700	6667	7100	7156
	Benzo (k) fluoranthene	2567	2400	2533	2500
	Benzo (ghi) perylene	3933	3467	3700	3700
	Benzo (a) pyrene	5067	4433	4633	4711
	Chrysene	5700	4867	5667	5411
	Dibenz (a,h) anthracene	890	810	820	840
	Fluoranthene	8100	6433	7900	7478
	Fluorene	1267	1267	1300	1278
	Indeno (1,2,3-cd) pyrene	3067	2700	2833	2867
	Naphthalene	1567	1600	1600	1589
	Perylene	1233	1063	1120	1139
	Phenanthrene	8400	7967	8400	8256
	Pyrene	6500	6233	6567	6433
Total Metals (µg/L)	Antimony	17.3	18.0	17.3	17.5
	Arsenic	232	230	226	229
	Beryllium	1.53	1.47	1.30	1.43
	Cadmium	< 0.51	< 0.51	< 0.51	< 0.51
	Chromium	9.23	8.67	7.77	8.56
	Cobalt	5.50	4.97	4.60	5.02
	Lead	7.67	6.53	5.63	6.61
	Manganese	75.5	66.6	61.7	68.0
	Nickel	13.7	12.7	11.5	12.6
	Selenium	20.1	18.6	17.6	18.8

Table 12. Static Process Data, Quench Tower Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Process Data	Units	
Emission Unit ID		803, Emission Point 10
Type of Process		Quenching
Type of Air Control Device		Baffles/Sprayers
Latitude of Stack (5 decimal places)		40.16349
Longitue of Stack (5 decimal Places		-79.88688
Type of Coal Charged During Test		Metallurgical Bituminous Coal
Yearly COG Generated	(mmscf/yr)	5,904.1
Yearly COG burned in Batteries	(mmscf/yr)	3,426.9
Yearly COG burned in Boilers	(mmscf/yr)	1,567.8
Yearly Natural Gas burned in Batteries	(mmscf/yr)	133.9
Pushing period during testing	(minutes)	12
Charging period during testing	(minutes)	11
Higher Heating Value COG	(BTU/scf)	510
Higher Heating Value Natural Gas	(BTU/scf)	1,020

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Process Data

Quench Tower

Emission Unit ID (same as Enclosure 1)	**803, Emission Point 10**
Type of Process	**Quenching**
Type of Air Control Device	**Baffles/Sprayers**
Latitude of Stack (5 decimal places)	**40.16349**
Longitue of Stack (5 decimal Places	**-79.88688**
Type of Coal Charged During Test	**Metallurgical Bituminous Coal**
Yearly COG Generated (MMscf/year	**5,904.10**
Yearly COG burned in Batteries	**3,426.90**
Yearly COG burned in Boilers	**1,567.80**
Yearly Natural Gas burned in Batteries	**133.92**

Methods	*0010-23 Method 315*				*0010-23 Method 315*				*0010-23 Method 315 Runs 1 and 2 Method 15, 6C, 10 Run 1 Method 320*				*0010-23 Run 3 Method 15, 6C, 10 Runs 2 and 3 Method 320*			
Test Data	Run 1				Run 2				Run 3				Run 4			
Date	10/27/16				10/31-11/1, 2016				11/01/16				11/1-11/2, 2016			
Start Time	3:29 AM				8:00 PM				10:32 AM				11:41 PM			
End Time	4:40 PM				9:14 AM				10:28 PM				1:03 PM			
Ovens Push	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)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
	B27	16.19	2435	12	B23	16.19	2435	12	B17	16.19	2435	12	C7	16.19	2435	12
	C27	16.19	2426	12	C23	16.19	2426	12	C17	16.19	2426	12	B9	16.19	2435	12
	B29	16.19	2435	12	B25	16.19	2435	12	B19	16.19	2435	12	C9	16.19	2426	12
	B2	16.19	2435	12	C25	16.19	2426	12	C19	16.19	2426	12	B11	16.19	2435	12
	C27	16.19	2435	12	B27	16.19	2435	12	B21	16.19	2435	12	C11	16.19	2426	12
	B4	16.19	2435	12	C27	16.19	2426	12	C21	16.19	2426	12	B13	16.19	2435	12
	C4	16.19	2435	12	B29	16.19	2435	12	B23	16.19	2435	12	C13	16.19	2426	12
	B6	16.19	2435	12	B2	16.19	2435	12	C23	16.19	2426	12	B15	16.19	2435	12
	C6	16.19	2435	12	C2	16.19	2435	12	B25	16.19	2435	12	C15	16.19	2426	12
	B8	16.19	2435	12	B4	16.19	2435	12	C25	16.19	2426	12	B17	16.19	2435	12
	C8	16.19	2435	12	C4	16.19	2435	12	B27	16.19	2435	12	C17	16.19	2426	12
	B10	16.19	2435	12	B6	16.19	2435	12	C27	16.19	2426	12	B19	16.19	2435	12
	C10	16.19	2426	12	C6	16.19	2435	12	B29	16.19	2435	12	C19	16.19	2426	12
	B12	16.19	2435	12	B8	16.19	2435	12	B2	16.19	2435	12	B21	16.19	2435	12
	C12	16.19	2426	12	C8	16.19	2435	12	C2	16.19	2435	12	C21	16.19	2426	12
	B14	16.19	2435	12	B10	16.19	2435	12	B4	16.19	2435	12	B23	16.19	2435	12
	C14	16.19	2426	12	C10	16.19	2426	12	C4	16.19	2435	12	C23	16.19	2426	12
	B16	16.19	2435	12	B12	16.19	2435	12	B6	16.19	2435	12	B25	16.19	2435	12
	C16	16.19	2426	12	C12	16.19	2426	12	C6	16.19	2435	12	C26	16.19	2426	12
	B18	16.19	2435	12	B14	16.19	2435	12	B8	16.19	2435	12	B27	16.19	2435	12
	C18	16.19	2426	12	C14	16.19	2426	12	C8	16.19	2435	12	C27	16.19	2426	12
	B20	16.19	2435	12	B16	16.19	2435	12	B10	16.19	2435	12	B29	16.19	2435	12
	C20	16.19	2426	12	C16	16.19	2426	12	C10	16.19	2426	12	B2	16.19	2435	12
	B22	16.19	2435	12	B18	16.19	2435	12	B12	16.19	2435	12	C2	16.19	2435	12
	C22	16.19	2426	12	C18	16.19	2426	12	C12	16.19	2426	12	B4	16.19	2435	12
	B24	16.19	2435	12	B20	16.19	2435	12	B14	16.19	2435	12	C4	16.19	2435	12
	C24	16.19	2426	12	C20	16.19	2426	12	C14	16.19	2426	12	B6	16.19	2435	12
	B26	16.19	2435	12	B22	16.19	2435	12	B16	16.19	2435	12	C6	16.19	2435	12
	C26	16.19	2426	12	C22	16.19	2426	12	C16	16.19	2426	12	B8	16.19	2435	12
	B28	16.19	2435	12	B24	16.19	2435	12	B18	16.19	2435	12	C8	16.19	2435	12
	B1	16.19	2435	12	C24	16.19	2426	12	C18	16.19	2426	12	B10	16.19	2435	12
	C1	16.19	2435	12	B26	16.19	2435	12	B20	16.19	2435	12	C10	16.19	2426	12
	B3	16.19	2435	12	C26	16.19	2426	12	C20	16.19	2426	12	B12	16.19	2435	12
	C3	16.19	2435	12	B28	16.19	2435	12	B22	16.19	2435	12	C12	16.19	2426	12
	B5	16.19	2435	12	B1	16.19	2435	12	C22	16.19	2426	12	B14	16.19	2435	12
	C5	16.19	2435	12	C1	16.19	2435	12	B24	16.19	2435	12	C14	16.19	2426	12
	B7	16.19	2435	12	B3	16.19	2435	12	C24	16.19	2426	12	B16	16.19	2435	12
	C7	16.19	2435	12	C3	16.19	2435	12	B26	16.19	2435	12	C16	16.19	2426	12
	B9	16.19	2435	12	B5	16.19	2435	12	C26	16.19	2426	12	B18	16.19	2435	12
	C9	16.19	2426	12	C5	16.19	2435	12	B28	16.19	2435	12	C18	16.19	2426	12
	B11	16.19	2435	12	B7	16.19	2435	12	B1	16.19	2435	12	B20	16.19	2435	12
	C11	16.19	2426	12	C7	16.19	2435	12	C1	16.19	2435	12	C20	16.19	2426	12
	B13	16.19	2435	12	B9	16.19	2435	12	B3	16.19	2435	12	B22	16.19	2435	12
	C13	16.19	2426	12	C9	16.19	2426	12	C3	16.19	2435	12	C22	16.19	2426	12
	B15	16.19	2435	12	B11	16.19	2435	12	B5	16.19	2435	12	B24	16.19	2435	12
	C15	16.19	2426	12	C11	16.19	2426	12					C24	16.19	2426	12
	B17	16.19	2435	12												
	C17	16.19	2426	12												
Total # Pushed	48	16.19	2432.2	12	46	16.19	2432.3	12	45	16.19	2432.0	12	46	16.19	2431.5	12

Quench Tower

Emission Unit ID (same as Enclosure 1)	**803, Emission Point 10**
Type of Process	**Quenching**
Type of Air Control Device	**Baffles/Sprayers**
Latitude of Stack (5 decimal places)	**40.16349**
Longitue of Stack (5 decimal Places	**-79.88688**
Type of Coal Charged During Test	**Metallurgical Bituminous Coal**
Yearly COG Generated (MMscf/year	**5,904.10**
Yearly COG burned in Batteries	**3,426.90**
Yearly COG burned in Boilers	**1,567.80**
Yearly Natural Gas burned in Batteries	**133.92**

Methods	*0010-23 Method 315*	*0010-23 Method 315*	*0010-23 Method 315 Runs 1 and 2 Method 15, 6C, 10 Run 1 Method 320*	*0010-23 Run 3 Method 15, 6C, 10 Runs 2 and 3 Method 320*
Test Data	Run 1	Run 2	Run 3	Run 4
Date	10/27/16	10/31-11/1, 2016	11/01/16	11/1-11/2, 2016
Start Time	3:29 AM	8:00 PM	10:32 AM	11:41 PM
End Time	4:40 PM	9:14 AM	10:28 PM	1:03 PM

	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)
Ovens Charged	B27		348	11	B23		2017	11	B17		1034	11	C7		2342	11
	C27		400	11	C23		2031	11	C17		1045	11	B9		2352	11
	B29		414	11	B25		2044	11	B19		1101	11	C9		4	11
	B2		425	11	C25		2056	11	C19		1113	11	B11		42	11
	C27		439	11	B27		2107	11	B21		1157	11	C11		53	11
	B4		451	11	C27		2120	11	C21		1211	11	B13		115	11
	C4		511	11	B29		2133	11	B23		1225	11	C13		232	11
	B6		522	11	B2		2145	11	C23		1237	11	B15		245	11
	C6		555	11	C2		2207	11	B25		1251	11	C15		259	11
	B8		609	11	B4		2217	11	C25		1304	11	B17		311	11
	C8		622	11	C4		2229	11	B27		1316	11	C17		322	11
	B10		637	11	B6		2240	11	C27		1329	11	B19		333	11
	C10		649	11	C6		2251	11	B29		1342	11	C19		343	11
	B12		701	11	B8		2302	11	B2		1417	11	B21		418	11
	C12		716	11	C8		2334	11	C2		1428	11	C21		429	11
	B14		737	11	B10		2346	11	B4		1443	11	B23		440	11
	C14		748	11	C10		21	11	C4		1453	11	C23		451	11
	B16		802	11	B12		33	11	B6		1507	11	B25		504	11
	C16		815	11	C12		48	11	C6		1520	11	C26		517	11
	B18		832	11	B14		102	11	B8		1538	11	B27		529	11
	C18		846	11	C14		116	11	C8		1551	11	C27		545	11
	B20		932	11	B16		131	11	B10		1605	11	B29		556	11
	C20		944	11	C16		147	11	C10		1649	11	B2		611	11
	B22		955	11	B18		202	11	B12		1702	11	C2		626	11
	C22		1007	11	C18		225	11	C12		1715	11	B4		639	11
	B24		1024	11	B20		303	11	B14		1728	11	C4		650	11
	C24		1037	11	C20		315	11	C14		1740	11	B6		701	11
	B26		1049	11	B22		328	11	B16		1753	11	C6		742	11
	C26		1106	11	C22		340	11	C16		1806	11	B8		756	11
	B28		1118	11	B24		354	11	B18		1818	11	C8		810	11
	B1		1212	11	C24		407	11	C18		1831	11	B10		825	11
	C1		1233	11	B26		420	11	B20		1915	11	C10		907	11
	B3		1244	11	C26		433	11	C20		1927	11	B12		924	11
	C3		1300	11	B28		446	11	B22		1940	11	C12		937	11
	B5		1312	11	B1		524	11	C22		1955	11	B14		953	11
	C5		1324	11	C1		536	11	B24		2007	11	C14		1005	11
	B7		1338	11	B3		548	11	C24		2019	11	B16		1018	11
	C7		1349	11	C3		602	11	B26		2033	11	C16		1029	11
	B9		1359	11	B5		617	11	C26		2053	11	B18		1043	11
	C9		1412	11	C5		631	11	B28		2106	11	C18		1053	11
	B11		1445	11	B7		646	11	B1		2144	11	B20		1055	11
	C11		1456	11	C7		700	11	C1		2156	11	C20		1206	11
	B13		1532	11	B9		741	11	B3		2207	11	B22		1219	11
	C13		1543	11	C9		755	11	C3		2218	11	C22		1234	11
	B15		1557	11	B11		850	11	B5		2231	11	B24		1246	11
	C15		1609	11	C11		908	11					C24		1258	11
	B17		1624	11												
	C17		1636	11												

Coke Produced During test (tons)	556.8	533.6	522	533.6
Avg. Coal Processed/Oven During test(Ton)	16.2	16.2	16.2	16.2
Higher Heating Value COG	510	510	510	510
Higher Heating Value of N.G.	1020	1020	1020	1020

Methods 5 and 29
Methods 5/202

Run 1

10/26-10/27, 2016
9:17 PM
5:50 AM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B9	16.19	2435	12
C9	16.19	2426	12
B11	16.19	2435	12
C11	16.19	2426	12
B13	16.19	2435	12
C13	16.19	2426	12
B15	16.19	2435	12
C15	16.19	2426	12
B17	16.19	2435	12
C17	16.19	2426	12
B19	16.19	2435	12
C19	16.19	2426	12
B21	16.19	2435	12
C21	16.19	2426	12
B23	16.19	2435	12
C23	16.19	2426	12
B25	16.19	2435	12
C25	16.19	2426	12
B27	16.19	2435	12
C27	16.19	2426	12
B29	16.19	2435	12
B2	16.19	2435	12
C2	16.19	2435	12
B4	16.19	2435	12
C4	16.19	2435	12
B6	16.19	2435	12
26	16.19	2431.5	12

Methods 5 and 29
Methods 5/202

Run 2

10/28/16
6:33 AM
2:33 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B9	16.19	2435	12
C9	16.19	2426	12
B11	16.19	2435	12
C11	16.19	2426	12
B13	16.19	2435	12
C13	16.19	2435	12
B15	16.19	2435	12
C15	16.19	2426	12
B17	16.19	2435	12
C17	16.19	2426	12
B19	16.19	2435	12
C19	16.19	2426	12
B21	16.19	2435	12
C21	16.19	2426	12
B23	16.19	2435	12
C23	16.19	2426	12
B25	16.19	2435	12
C25	16.19	2426	12
B27	16.19	2435	12
C27	16.19	2426	12
B29	16.19	2435	12
B2	16.19	2435	12
C2	16.19	2435	12
B4	16.19	2435	12
C4	16.19	2435	12
B6	16.19	2435	12
C6	16.19	2435	12
B8	16.19	2435	12
C8	16.19	2435	12
B10	16.19	2435	12
30	16.19	2432.3	12

Methods 5 and 29
Methods 5/202

Run 3

10/31/16
9:37 AM
7:15 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B18	16.19	2435	12
C18	16.19	2426	12
B20	16.19	2435	12
C20	16.19	2426	12
B22	16.19	2435	12
C22	16.19	2426	12
B24	16.19	2435	12
C24	16.19	2426	12
B26	16.19	2435	12
C26	16.19	2426	12
B28	16.19	2435	12
B1	16.19	2435	12
C1	16.19	2435	12
B3	16.19	2435	12
C3	16.19	2435	12
B5	16.19	2435	12
C5	16.19	2435	12
B7	16.19	2435	12
C7	16.19	2435	12
B9	16.19	2435	12
C9	16.19	2426	12
B11	16.19	2435	12
C11	16.19	2426	12
B13	16.19	2435	12
C13	16.19	2426	12
B15	16.19	2435	12
C15	16.19	2426	12
B17	16.19	2435	12
C17	16.19	2426	12
B19	16.19	2435	12
C19	16.19	2426	12
B21	16.19	2435	12
C21	16.19	2426	12
B23	16.19	2435	12
34	16.19	2431.8	12

Methods 5 and 29
Methods 5/202

Run 1

10/26-10/27, 2016
9:17 PM
5:50 AM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)
B9		2120	11
C9		2132	11
B11		2204	11
C11		2215	11
B13		2228	11
C13		2246	11
B15		2259	11
C15		2336	11
B17		2349	11
C17		10	11
B19		29	11
C19		41	11
B21		54	11
C21		107	11
B23		119	11
C23		239	11
B25		254	11
C25		329	11
B27		348	11
C27		400	11
B29		414	11
B2		425	11
C2		439	11
B4		451	11
C4		511	11
B6		522	11

301.6
16.2
510
1020

Methods 5 and 29
Methods 5/202

Run 2

10/28/16
6:33 AM
2:33 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)
B9		641	11
C9		653	11
B11		706	11
C11		719	11
B13		742	11
C13		806	11
B15		817	11
C15		831	11
B17		845	11
C17		900	11
B19		913	11
C19		925	11
B21		1018	11
C21		1033	11
B23		1047	11
C23		1059	11
B25		1113	11
C25		1126	11
B27		1139	11
C27		1151	11
B29		1205	11
B2		1248	11
C2		1302	11
B4		1314	11
C4		1326	11
B6		1339	11
C6		1353	11
B8		1405	11
C8		1417	11
B10		1435	11

348
16.2
510
1020

Methods 5 and 29
Methods 5/202

Run 3

10/31/16
9:37 AM
7:15 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)
B18		950	11
C18		1001	11
B20		1051	11
C20		1103	11
B22		1116	11
C22		1130	11
B24		1142	11
C24		1157	11
B26		1210	11
C26		1225	11
B28		1240	11
B1		1332	11
C1		1345	11
B3		1358	11
C3		1410	11
B5		1422	11
C5		1435	11
B7		1449	11
C7		1500	11
B9		1545	11
C9		1601	11
B11		1640	11
C11		1655	11
B13		1713	11
C13		1739	11
B15		1759	11
C15		1812	11
B17		1825	11
C17		1838	11
B19		1851	11
C19		1903	11
B21		1950	11
C21		2004	11
B23		2017	11

394.4
16.2
510
1020

Methods 0031 and 316

Run 1

10/25/16
9:10 AM
5:32 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B26	16.19	2435	12
C26	16.19	2426	12
B28	16.19	2435	12
B1	16.19	2435	12
C1	16.19	2435	12
B3	16.19	2435	12
C3	16.19	2435	12
B5	16.19	2435	12
C5	16.19	2435	12
B7	16.19	2435	12
C7	16.19	2435	12
B9	16.19	2435	12
C9	16.19	2426	12
B11	16.19	2435	12
C11	16.19	2426	12
B13	16.19	2435	12
C13	16.19	2426	12
B15	16.19	2435	12
C15	16.19	2426	12
B17	16.19	2435	12
C17	16.19	2426	12
B19	16.19	2435	12
C19	16.19	2426	12
B21	16.19	2435	12
C21	16.19	2426	12
B23	16.19	2435	12
C23	16.19	2426	12
B25	16.19	2435	12
C25	16.19	2426	12
29	16.19	2431.9	12

Methods 0031 and 316

Run 2

10/25-10/26, 2016
6:06 PM
4:55 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
C27	16.19	2426	12
B29	16.19	2435	12
B2	16.19	2435	12
C2	16.19	2435	12
B4	16.19	2435	12
C4	16.19	2435	12
B6	16.19	2435	12
C6	16.19	2435	12
B8	16.19	2435	12
C8	16.19	2435	12
B10	16.19	2435	12
C2	16.19	2435	12
B4	16.19	2435	12
C4	16.19	2435	12
B6	16.19	2435	12
C6	16.19	2435	12
B8	16.19	2435	12
C8	16.19	2435	12
B10	16.19	2435	12
C10	16.19	2426	12
B12	16.19	2435	12
C12	16.19	2426	12
B14	16.19	2435	12
C14	16.19	2426	12
B16	16.19	2435	12
C16	16.19	2426	12
B18	16.19	2435	12
C18	16.19	2426	12
B20	16.19	2435	12
29	16.19	2433.1	12

Methods 0031 and 316

Run 3

10/26-10/27, 2016
5:28 PM
1:23 AM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
C22	16.19	2426	12
B24	16.19	2435	12
C24	16.19	2426	12
B26	16.19	2435	12
C26	16.19	2426	12
B28	16.19	2435	12
B1	16.19	2435	12
C1	16.19	2435	12
B3	16.19	2435	12
C3	16.19	2435	12
B5	16.19	2435	12
C5	16.19	2435	12
B7	16.19	2435	12
C7	16.19	2435	12
B9	16.19	2435	12
C9	16.19	2426	12
B11	16.19	2435	12
C11	16.19	2426	12
B13	16.19	2435	12
C13	16.19	2426	12
B15	16.19	2435	12
C15	16.19	2426	12
B17	16.19	2435	12
C17	16.19	2426	12
B19	16.19	2435	12
C19	16.19	2426	12
B21	16.19	2435	12
C21	16.19	2426	12
B23	16.19	2435	12
29	16.19	2431.9	12

Methods 0031 and 316 *Methods 0031 and 316* *Methods 0031 and 316*

Run 1				Run 2				Run 3			
10/25/16				10/25-10/26, 2016				10/26-10/27, 2016			
9:10 AM				6:06 PM				5:28 PM			
5:32 PM				4:55 PM				1:23 AM			
Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes) Charging Time (min)
B26		922	11	C27		1820	11	C22		1742	11
C26		935	11	B29		1834	11	B24		1754	11
B28		948	11	B2		1908	11	C24		1807	11
B1		1042	11	C2		1920	11	B26		1821	11
C1		1054	11	B4		1935	11	C26		1833	11
B3		1106	11	C4		1953	11	B28		1847	11
C3		1121	11	B6		2006	11	B1		1924	11
B5		1133	11	C6		2019	11	C1		1936	11
C5		1148	11	B8		2033	11	B3		1948	11
B7		1215	11	C8		2054	11	C3		2006	11
C7		1229	11	B10		2122	11	B5		2018	11
B9		1243	11	C2		1224	11	C5		2030	11
C9		1257	11	B4		1246	11	B7		2043	11
B11		1328	11	C4		1258	11	C7		2105	11
C11		1344	11	B6		1310	11	B9		2120	11
B13		1356	11	C6		1325	11	C9		2132	11
C13		1408	11	B8		1337	11	B11		2204	11
B15		1420	11	C8		1347	11	C11		2215	11
C15		1432	11	B10		1403	11	B13		2228	11
B17		1453	11	C10		1417	11	C13		2246	11
C17		1507	11	B12		1429	11	B15		2259	11
B19		1539	11	C12		1441	11	C15		2336	11
C19		1555	11	B14		1456	11	B17		2349	11
B21		1619	11	C14		1506	11	C17		10	11
C21		1632	11	B16		1537	11	B19		29	11
B23		1648	11	C16		1550	11	C19		41	11
C23		1700	11	B18		1603	11	B21		54	11
B25		1714	11	C18		1617	11	C21		107	11
C25		1728	11	B20		1653	11	B23		119	11

336.4	336.4	336.4
16.2	16.2	16.2
510	510	510
1020	1020	1020

REPORT - APPENDIX B

Montrose Field Data Sheets

Method 5/202

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/27	21:17:01	20.44	0.19
2	2016/10/27	21:18:01	20.43	0.19
3	2016/10/27	21:19:01	20.55	0.10
4	2016/10/27	21:20:01	20.55	0.10
5	2016/10/27	21:30:01	20.40	0.23
6	2016/10/27	21:31:01	20.22	0.38
7	2016/10/27	21:32:01	20.51	0.13
8	2016/10/27	21:33:01	20.54	0.10
9	2016/10/27	21:42:01	20.52	0.13
10	2016/10/27	21:43:01	20.32	0.28
11	2016/10/27	21:44:01	20.52	0.12
12	2016/10/27	21:45:01	20.53	0.11
13	2016/10/27	21:54:01	20.34	0.27
14	2016/10/27	21:55:01	20.25	0.33
15	2016/10/27	21:56:01	20.48	0.13
16	2016/10/27	21:57:01	20.50	0.11
17	2016/10/27	22:07:01	20.27	0.32
18	2016/10/27	22:08:01	20.49	0.13
19	2016/10/27	22:09:01	20.50	0.11
20	2016/10/27	22:10:01	20.50	0.11
21	2016/10/27	22:17:01	20.49	0.12
22	2016/10/27	22:18:01	20.48	0.11
23	2016/10/27	22:19:01	20.13	0.40
24	2016/10/27	22:20:01	20.41	0.17
25	2016/10/27	22:46:01	20.44	0.14
26	2016/10/27	22:47:01	20.23	0.30
27	2016/10/27	22:48:01	20.43	0.14
28	2016/10/27	22:49:01	20.44	0.13
29	2016/10/27	22:59:01	20.25	0.29
30	2016/10/27	23:00:01	20.40	0.16
31	2016/10/27	23:01:01	20.44	0.13
32	2016/10/27	23:02:01	20.44	0.13
33	2016/10/27	23:42:01	20.30	0.22
34	2016/10/27	23:43:01	20.37	0.14
35	2016/10/27	23:44:01	20.43	0.08
36	2016/10/27	23:45:01	20.43	0.08
37	2016/10/27	23:52:01	20.43	0.07
38	2016/10/27	23:53:01	20.21	0.24
39	2016/10/27	23:54:01	20.39	0.10
40	2016/10/27	23:55:01	20.42	0.08
41	2016/10/28	00:06:01	20.39	0.10
42	2016/10/28	00:07:01	20.21	0.24
43	2016/10/28	00:08:01	20.40	0.10
44	2016/10/28	00:09:01	20.41	0.08
45	2016/10/28	00:21:01	20.27	0.20
46	2016/10/28	00:22:01	20.34	0.13
47	2016/10/28	00:23:01	20.40	0.09
48	2016/10/28	00:24:01	20.40	0.08
49	2016/10/28	00:35:01	20.25	0.21
50	2016/10/28	00:36:01	20.30	0.16
51	2016/10/28	00:37:01	20.39	0.09
52	2016/10/28	00:38:01	20.39	0.08
53	2016/10/28	00:53:01	20.24	0.21
54	2016/10/28	00:54:01	20.31	0.14
55	2016/10/28	00:55:01	20.38	0.09
56	2016/10/28	00:56:01	20.38	0.08
57	2016/10/28	01:06:01	20.31	0.15
58	2016/10/28	01:07:01	20.30	0.14
59	2016/10/28	01:08:01	20.38	0.08
60	2016/10/28	01:09:01	20.38	0.08
61	2016/10/28	01:46:01	20.19	0.25
62	2016/10/28	01:47:01	20.35	0.11
63	2016/10/28	01:48:01	20.38	0.09
64	2016/10/28	01:49:01	20.38	0.09
65	2016/10/28	01:59:01	20.17	0.26
66	2016/10/28	02:00:01	20.36	0.10

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
67	2016/10/28	02:01:01	20.37	0.09
68	2016/10/28	02:02:01	20.37	0.09
69	2016/10/28	02:11:01	20.24	0.21
70	2016/10/28	02:12:01	20.30	0.14
71	2016/10/28	02:13:01	20.37	0.09
72	2016/10/28	02:14:01	20.37	0.09
73	2016/10/28	02:25:01	20.16	0.25
74	2016/10/28	02:26:01	20.35	0.10
75	2016/10/28	02:27:01	20.36	0.09
76	2016/10/28	02:28:01	20.36	0.09
77	2016/10/28	02:36:01	20.24	0.19
78	2016/10/28	02:37:01	20.30	0.14
79	2016/10/28	02:38:01	20.37	0.09
80	2016/10/28	02:39:01	20.37	0.09
81	2016/10/28	02:50:01	20.19	0.23
82	2016/10/28	02:51:01	20.33	0.11
83	2016/10/28	02:52:01	20.36	0.09
84	2016/10/28	02:53:01	20.36	0.09
85	2016/10/28	03:04:01	20.15	0.27
86	2016/10/28	03:05:01	20.33	0.12
87	2016/10/28	03:06:01	20.37	0.09
88	2016/10/28	03:07:01	20.37	0.09
89	2016/10/28	03:18:01	20.12	0.25
90	2016/10/28	03:19:01	20.34	0.10
91	2016/10/28	03:20:01	20.36	0.09
92	2016/10/28	03:21:01	20.37	0.09
93	2016/10/28	03:32:01	20.36	0.10
94	2016/10/28	03:33:01	20.16	0.26
95	2016/10/28	03:34:01	20.36	0.10
96	2016/10/28	03:35:01	20.37	0.09
97	2016/10/28	04:22:01	20.15	0.23
98	2016/10/28	04:23:01	20.33	0.11
99	2016/10/28	04:24:01	20.36	0.10
100	2016/10/28	04:25:01	20.36	0.09
101	2016/10/28	04:35:01	20.25	0.20
102	2016/10/28	04:36:01	20.25	0.17
103	2016/10/28	04:37:01	20.36	0.10
104	2016/10/28	04:38:01	20.36	0.10
105	2016/10/28	04:46:01	20.32	0.14
106	2016/10/28	04:47:01	20.19	0.24
107	2016/10/28	04:48:01	20.35	0.10
108	2016/10/28	04:49:01	20.36	0.10
109	2016/10/28	04:58:01	20.33	0.13
110	2016/10/28	04:59:01	20.20	0.22
111	2016/10/28	05:00:01	20.35	0.10
112	2016/10/28	05:01:01	20.36	0.10
113	2016/10/28	05:11:01	20.16	0.28
114	2016/10/28	05:12:01	20.32	0.13
115	2016/10/28	05:13:01	20.36	0.10
116	2016/10/28	05:14:01	20.36	0.10
117	2016/10/28	05:24:01	20.29	0.17
118	2016/10/28	05:25:01	20.25	0.18
119	2016/10/28	05:26:01	20.37	0.10
120	2016/10/28	05:27:01	20.37	0.10
RUN 1 AVERAGES			**20.35**	**0.15**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/28	06:34:01	20.19	0.28
2	2016/10/28	06:35:01	20.35	0.13
3	2016/10/28	06:36:01	20.39	0.11
4	2016/10/28	06:37:01	20.39	0.10
5	2016/10/28	06:53:01	20.23	0.22
6	2016/10/28	06:54:01	20.36	0.12
7	2016/10/28	06:55:01	20.40	0.10
8	2016/10/28	06:56:01	20.41	0.10
9	2016/10/28	07:04:01	20.24	0.26
10	2016/10/28	07:05:01	20.40	0.12
11	2016/10/28	07:06:01	20.43	0.10
12	2016/10/28	07:07:01	20.43	0.10
13	2016/10/28	07:19:01	20.36	0.18
14	2016/10/28	07:20:01	20.26	0.24
15	2016/10/28	07:21:01	20.43	0.11
16	2016/10/28	07:22:01	20.44	0.11
17	2016/10/28	07:41:01	20.27	0.23
18	2016/10/28	07:42:01	20.45	0.11
19	2016/10/28	07:43:01	20.46	0.11
20	2016/10/28	07:44:01	20.46	0.11
21	2016/10/28	08:04:01	20.31	0.23
22	2016/10/28	08:05:01	20.43	0.12
23	2016/10/28	08:06:01	20.47	0.11
24	2016/10/28	08:07:01	20.47	0.10
25	2016/10/28	08:15:01	20.26	0.28
26	2016/10/28	08:16:01	20.44	0.12
27	2016/10/28	08:17:01	20.47	0.10
28	2016/10/28	08:18:01	20.46	0.10
29	2016/10/28	08:31:01	20.55	0.22
30	2016/10/28	08:32:01	20.63	0.14
31	2016/10/28	08:33:01	20.68	0.10
32	2016/10/28	08:34:01	20.69	0.10
33	2016/10/28	08:44:01	20.52	0.26
34	2016/10/28	08:45:01	20.68	0.11
35	2016/10/28	08:46:01	20.70	0.10
36	2016/10/28	08:47:01	20.70	0.10
37	2016/10/28	09:00:01	20.51	0.25
38	2016/10/28	09:01:01	20.69	0.10
39	2016/10/28	09:02:01	20.71	0.10
40	2016/10/28	09:03:01	20.71	0.10
41	2016/10/28	09:12:01	20.61	0.18
42	2016/10/28	09:13:01	20.62	0.17
43	2016/10/28	09:14:01	20.70	0.10
44	2016/10/28	09:15:01	20.71	0.10
45	2016/10/28	09:25:01	20.55	0.24
46	2016/10/28	09:26:01	20.70	0.11
47	2016/10/28	09:27:01	20.71	0.10
48	2016/10/28	09:28:01	20.72	0.10
49	2016/10/28	10:08:01	20.65	0.15
50	2016/10/28	10:09:01	20.61	0.16
51	2016/10/28	10:10:01	20.70	0.10
52	2016/10/28	10:11:01	20.71	0.10
53	2016/10/28	10:33:01	20.52	0.26
54	2016/10/28	10:34:01	20.68	0.11
55	2016/10/28	10:35:01	20.70	0.10
56	2016/10/28	10:36:01	20.71	0.10
57	2016/10/28	10:46:01	20.52	0.26
58	2016/10/28	10:47:01	20.66	0.13
59	2016/10/28	10:48:01	20.69	0.10
60	2016/10/28	10:49:01	20.70	0.10
61	2016/10/28	10:59:01	20.55	0.21
62	2016/10/28	11:00:01	20.68	0.11
63	2016/10/28	11:01:01	20.70	0.10
64	2016/10/28	11:02:01	20.71	0.10
65	2016/10/28	11:10:01	20.52	0.24
66	2016/10/28	11:11:01	20.68	0.11

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
67	2016/10/28	11:12:01	20.70	0.10
68	2016/10/28	11:13:01	20.70	0.10
69	2016/10/28	11:25:01	20.55	0.20
70	2016/10/28	11:26:01	20.69	0.10
71	2016/10/28	11:27:01	20.70	0.10
72	2016/10/28	11:28:01	20.71	0.10
73	2016/10/28	11:38:01	20.57	0.22
74	2016/10/28	11:39:01	20.66	0.13
75	2016/10/28	11:40:01	20.70	0.10
76	2016/10/28	11:41:01	20.70	0.10
77	2016/10/28	11:51:01	20.54	0.20
78	2016/10/28	11:52:01	20.69	0.10
79	2016/10/28	11:53:01	20.70	0.10
80	2016/10/28	11:54:01	20.70	0.10
81	2016/10/28	12:05:01	20.50	0.28
82	2016/10/28	12:06:01	20.68	0.11
83	2016/10/28	12:07:01	20.70	0.10
84	2016/10/28	12:08:01	20.70	0.10
85	2016/10/28	12:47:01	20.60	0.18
86	2016/10/28	12:48:01	20.60	0.16
87	2016/10/28	12:49:01	20.68	0.10
88	2016/10/28	12:50:01	20.69	0.10
89	2016/10/28	13:01:01	20.49	0.26
90	2016/10/28	13:02:01	20.66	0.11
91	2016/10/28	13:03:01	20.68	0.10
92	2016/10/28	13:04:01	20.68	0.10
93	2016/10/28	13:13:01	20.48	0.28
94	2016/10/28	13:14:01	20.64	0.13
95	2016/10/28	13:15:01	20.67	0.10
96	2016/10/28	13:16:01	20.67	0.10
97	2016/10/28	13:26:01	20.46	0.26
98	2016/10/28	13:27:01	20.65	0.10
99	2016/10/28	13:28:01	20.67	0.10
100	2016/10/28	13:29:01	20.67	0.10
101	2016/10/28	13:38:01	20.47	0.25
102	2016/10/28	13:39:01	20.64	0.10
103	2016/10/28	13:40:01	20.66	0.10
104	2016/10/28	13:41:01	20.66	0.10
105	2016/10/28	13:52:01	20.65	0.10
106	2016/10/28	13:53:01	20.49	0.22
107	2016/10/28	13:54:01	20.64	0.10
108	2016/10/28	13:55:01	20.65	0.09
109	2016/10/28	14:04:01	20.49	0.24
110	2016/10/28	14:05:01	20.61	0.11
111	2016/10/28	14:06:01	20.64	0.09
112	2016/10/28	14:07:01	20.65	0.09
113	2016/10/28	14:17:01	20.47	0.26
114	2016/10/28	14:18:01	20.60	0.12
115	2016/10/28	14:19:01	20.64	0.09
116	2016/10/28	14:20:01	20.65	0.09
117	2016/10/28	14:30:01	20.48	0.24
118	2016/10/28	14:31:01	20.63	0.09
119	2016/10/28	14:32:01	20.65	0.09
120	2016/10/28	14:33:01	20.65	0.09
RUN 2 AVERAGES			**20.58**	**0.14**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/31	09:38:01	20.60	0.23
2	2016/10/31	09:39:01	20.67	0.17
3	2016/10/31	09:40:01	20.73	0.13
4	2016/10/31	09:41:01	20.73	0.13
5	2016/10/31	10:00:01	20.73	0.13
6	2016/10/31	10:01:01	20.56	0.26
7	2016/10/31	10:02:01	20.64	0.19
8	2016/10/31	10:03:01	20.71	0.13
9	2016/10/31	10:50:01	20.55	0.27
10	2016/10/31	10:51:01	20.62	0.20
11	2016/10/31	10:52:01	20.70	0.13
12	2016/10/31	10:53:01	20.70	0.13
13	2016/10/31	11:03:01	20.45	0.38
14	2016/10/31	11:04:01	20.58	0.25
15	2016/10/31	11:05:01	20.70	0.13
16	2016/10/31	11:06:01	20.72	0.13
17	2016/10/31	11:15:01	20.36	0.44
18	2016/10/31	11:16:01	20.53	0.28
19	2016/10/31	11:17:01	20.69	0.14
20	2016/10/31	11:18:01	20.69	0.13
21	2016/10/31	11:29:01	20.34	0.46
22	2016/10/31	11:30:01	20.53	0.29
23	2016/10/31	11:31:01	20.70	0.14
24	2016/10/31	11:32:01	20.71	0.14
25	2016/10/31	11:41:01	20.43	0.39
26	2016/10/31	11:42:01	20.56	0.26
27	2016/10/31	11:43:01	20.70	0.14
28	2016/10/31	11:44:01	20.71	0.13
29	2016/10/31	11:55:01	20.47	0.32
30	2016/10/31	11:56:01	20.58	0.22
31	2016/10/31	11:57:01	20.68	0.13
32	2016/10/31	11:58:01	20.69	0.13
33	2016/10/31	12:08:01	20.69	0.13
34	2016/10/31	12:09:01	20.60	0.20
35	2016/10/31	12:10:01	20.62	0.17
36	2016/10/31	12:11:01	20.66	0.13
37	2016/10/31	12:25:01	20.48	0.28
38	2016/10/31	12:26:01	20.57	0.20
39	2016/10/31	12:27:01	20.66	0.13
40	2016/10/31	12:28:01	20.68	0.13
41	2016/10/31	12:38:01	20.52	0.29
42	2016/10/31	12:39:01	20.58	0.22
43	2016/10/31	12:40:01	20.66	0.14
44	2016/10/31	12:41:01	20.68	0.13
45	2016/10/31	13:32:01	20.28	0.40
46	2016/10/31	13:33:01	20.40	0.29
47	2016/10/31	13:34:01	20.59	0.13
48	2016/10/31	13:35:01	20.63	0.11
49	2016/10/31	13:44:01	20.36	0.37
50	2016/10/31	13:45:01	20.48	0.24
51	2016/10/31	13:46:01	20.61	0.13
52	2016/10/31	13:47:01	20.63	0.12
53	2016/10/31	13:56:01	20.47	0.29
54	2016/10/31	13:57:01	20.48	0.26
55	2016/10/31	13:58:01	20.58	0.16
56	2016/10/31	13:59:01	20.62	0.13
57	2016/10/31	14:09:01	20.41	0.34
58	2016/10/31	14:10:01	20.50	0.24
59	2016/10/31	14:11:01	20.60	0.14
60	2016/10/31	14:12:01	20.61	0.13
61	2016/10/31	14:20:01	20.37	0.37
62	2016/10/31	14:21:01	20.48	0.26
63	2016/10/31	14:22:01	20.60	0.14
64	2016/10/31	14:23:01	20.62	0.13
65	2016/10/31	14:35:01	20.53	0.17
66	2016/10/31	14:36:01	20.57	0.15

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
67	2016/10/31	14:37:01	20.60	0.13
68	2016/10/31	14:38:01	20.61	0.13
69	2016/10/31	14:47:01	20.44	0.27
70	2016/10/31	14:48:01	20.52	0.19
71	2016/10/31	14:49:01	20.60	0.13
72	2016/10/31	14:50:01	20.60	0.13
73	2016/10/31	14:59:01	20.29	0.41
74	2016/10/31	15:00:01	20.41	0.29
75	2016/10/31	15:01:01	20.57	0.14
76	2016/10/31	15:02:01	20.60	0.12
77	2016/10/31	15:38:01	20.56	0.19
78	2016/10/31	15:39:01	20.59	0.16
79	2016/10/31	15:40:01	20.63	0.14
80	2016/10/31	15:41:01	20.64	0.14
81	2016/10/31	15:59:01	20.59	0.18
82	2016/10/31	16:00:01	20.60	0.16
83	2016/10/31	16:01:01	20.63	0.15
84	2016/10/31	16:02:01	20.64	0.15
85	2016/10/31	16:38:01	20.50	0.27
86	2016/10/31	16:39:01	20.56	0.20
87	2016/10/31	16:40:01	20.62	0.15
88	2016/10/31	16:41:01	20.63	0.15
89	2016/10/31	16:52:01	20.38	0.37
90	2016/10/31	16:53:01	20.48	0.26
91	2016/10/31	16:54:01	20.60	0.15
92	2016/10/31	16:55:01	20.61	0.15
93	2016/10/31	17:10:01	20.55	0.18
94	2016/10/31	17:11:01	20.58	0.16
95	2016/10/31	17:12:01	20.62	0.15
96	2016/10/31	17:13:01	20.63	0.15
97	2016/10/31	17:36:01	20.35	0.41
98	2016/10/31	17:37:01	20.49	0.27
99	2016/10/31	17:38:01	20.62	0.15
100	2016/10/31	17:39:01	20.63	0.15
101	2016/10/31	18:10:01	20.46	0.31
102	2016/10/31	18:11:01	20.51	0.24
103	2016/10/31	18:12:01	20.57	0.16
104	2016/10/31	18:13:01	20.59	0.15
105	2016/10/31	18:23:01	20.32	0.41
106	2016/10/31	18:24:01	20.45	0.27
107	2016/10/31	18:25:01	20.58	0.15
108	2016/10/31	18:26:01	20.59	0.15
109	2016/10/31	18:37:01	20.55	0.17
110	2016/10/31	18:38:01	20.56	0.16
111	2016/10/31	18:39:01	20.58	0.15
112	2016/10/31	18:40:01	20.59	0.15
113	2016/10/31	18:49:01	20.55	0.18
114	2016/10/31	18:50:01	20.57	0.16
115	2016/10/31	18:51:01	20.59	0.15
116	2016/10/31	18:52:01	20.60	0.15
117	2016/10/31	19:02:01	20.36	0.38
118	2016/10/31	19:03:01	20.49	0.25
119	2016/10/31	19:04:01	20.60	0.15
120	2016/10/31	19:05:01	20.61	0.15
RUN 3 AVERAGES			**20.57**	**0.20**

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

Client	ArcelorMittal	**Date**	Oct. 27-28, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 1
Unit	Quench Tower	**Start Time**	21:17
Operation	Normal	**End Time**	5:50
Tester(s)	JV		

Cal. Gas	LOW		MID		HIGH		Tank ID			Method 205 Cylinder	Method 205 Conc.	Span	Conc. Units	Response Time (sec)	
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	LOW	MID	HIGH					Up	Down
O2	N/A	N/A	10.21	51.0	20.01	100.0	N/A	CC465758	CC3414	NA	NA	20.01	d. vol. %	40	40
CO2	N/A	N/A	10.08	50.9	19.81	100.0	N/A	CC465758	CC3414	NA	NA	19.81	d. vol. %	45	45
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	0.09	0.15	0.11	0.25	0.10	20.01	0.1			
	Mid	10.21	10.17	10.11	-0.30	10.12	-0.25	0.05	20.01	10.115	20.35	20.64	d. vol. %
CO2	Zero		0.05	0.10	0.25	0.09	0.20	-0.05	19.81	0.095			
	Mid	10.08	9.89	9.81	-0.40	9.80	-0.45	-0.05	19.81	9.805	0.15	0.05	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					0	10.17	50.82		0	20.10	100.45		20.01	d. vol. %
CO2	0.05	0.25					0	9.89	49.92		0	20.15	101.72		19.81	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**	Oct. 28, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 2
Unit	Quench Tower	**Start Time**	6:33
Operation	Normal	**End Time**	14:33
Tester(s)	JV		

Cal. Gas	LOW		MID		HIGH		Tank ID			Span	Conc. Units	Response Time (sec)	
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	LOW	MID	HIGH			Up	Down
O2	N/A	N/A	10.21	51.0	20.01	100.0	N/A	CC465758	CC3414	20.01	d. vol. %		
CO2	N/A	N/A	10.08	50.9	19.81	100.0	N/A	CC465758	CC3414	19.81	d. vol. %		
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	0.13	0.35	0.10	20.01	0.12			
	Mid	10.21	10.17	10.12	-0.25	10.18	0.05	0.30	20.01	10.15	20.58	20.82	d. vol. %
CO2	Zero		0.05	0.09	0.20	0.13	0.40	0.20	19.81	0.11			
	Mid	10.08	9.89	9.80	-0.45	9.77	-0.61	-0.15	19.81	9.785	0.14	0.03	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Oct. 31, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	9:37
Operation	Normal	**End Time**	19:15
Tester(s)	JV		

Cal. Gas	LOW Conc.	LOW (% of Span)	MID Conc.	MID (% of Span)	HIGH Conc.	HIGH (% of Span)	Tank ID LOW	Tank ID MID	Tank ID HIGH	Span	Conc. Units	Response Time (sec) Up	Response Time (sec) Down
O2	N/A	N/A	10.21	51.0	20.01	100.0	N/A	CC465758	CC3414	20.01	d. vol. %		
CO2	N/A	N/A	10.08	50.9	19.81	100.0	N/A	CC465758	CC3414	19.81	d. vol. %		
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	0.10	0.20	-0.05	20.01	0.105			
	Mid	10.21	10.17	10.12	-0.25	10.19	0.10	0.35	20.01	10.155	20.57	20.79	d. vol. %
CO2	Zero		0.05	0.09	0.20	0.11	0.30	0.10	19.81	0.1			
	Mid	10.08	9.89	9.80	-0.45	9.78	-0.56	-0.10	19.81	9.79	0.20	0.11	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	Oct. 27-28, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Quench Tower		Test Start Time:	9:17 PM	
Unit Operation:	Normal		Test Finish Time:	5:50 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:	1936		CO + N2	79.30	% dv
Meter $DH_{@}$ (0.75 scfm)	1.830	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	0.998		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	120	minutes	Water Collected (W_f - W_i)	275.3	g
Barometric Pressure (Pbar)	29.52	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	12.980	scf
Stack Static Pressure (Pg)	0.10	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	12.980	scf
Stack Diameter (Ds) (L if rectangular)	600.0	inches	Volume Dry Gas Metered (Vm)	52.148	dacf
Stack Width (enter NA if circular)	216.0	inches	Vol. Dry Gas Metered Stand.(Vm(std))	51.290	dscf
Nozzle Diameter (Dn) (NA if NA)	0.337	inches	Volume Dry Gas Metered (Vm(m^3))	1.477	dacm
O2	20.64	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.452	dscm
CO2	0.05	% dv	Stack Absolute Pressure (Ps)	29.53	in. Hg
Product Rate (enter NA if not needed)	NA	input ton/hr	Stack Absolute Temperature (Tsavg)	631.3	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	12.68	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	0.4294	vol. fraction
Sample Calculation Title	Particulate and CEMS		H2O in the gas from test data (Bws)	0.2020	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)	0.2020	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	28.83	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	26.65	lb/lb-mole
Calculations			Gas Velocity (Vs)	17.25	ft/s
Meter Temperature (Tm)	69.5	F	Is the stack circular or rectangular?	RECTANGULAR	
Stack Temperature (Tsavg)	171.6	F	Area Stack (As)	900.00	ft^2
Orifice Pressure Drop (dHavg)	0.584	in. H_2O	Actual Gas Flowrate	931,712	acfm
GasVelocity Head (dP)' avg	0.2682	in. H_2O^1/2	Standard Gas Flowrate	768,554	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	613,334	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	26,383	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	21,763	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	17,368	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000619	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	101.3	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	8.55	hours			
# of Quenches	24	Quenches/test			
Avg. # of Quenches per hour	3.30	Quenches/hour			
Minutes per Quench	5.00	minutes/Quench			

FILTERABLE PARTICULATE (METHOD 5)

Acetone Wash Particulate (Blank Corrected)	13.70	mg
Filter Particulate	9.40	mg
Total Filterable Particulate Mass (m_n)	23.10	mg
Emission Concentration	0.0069	gr/dscf
Emission Concentration	15.91	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

CONDENSABLE PARTICULATE (METHOD 202)

Inorganic Particulate Mass (m_n)	7.56	mg
Condensable Inorganic Concentration (Uncorrect	5.207	mg/dscm
Organic Particulate Mass (m_n)	5.40	mg
Condensable Organic Concentration (Uncorrecte	3.718	mg/dscm
Total Condensable Particulate Mass (m_n) (Blank	12.36	mg
Emission Concentration	0.0037	gr/dscf
Emission Concentration	8.513	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

TOTAL PARTICULATE (METHODS 5/202)

Total Particulate Mass (m_n)	35.47	mg
Emission Concentration	0.0106	gr/dscf
Emission Concentration	24.42	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

ArcelorMittal Quench Tower — **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	0.085	0.292	0.70	180	63	64
A-1	0.085	0.292	0.70	180	63	64
A-2	0.079	0.281	0.65	179	64	64
A-2	0.069	0.263	0.57	167	64	64
A-3	0.085	0.292	0.70	173	64	65
A-3	0.085	0.292	0.70	170	64	67
B-1	0.069	0.263	0.51	169	64	67
B-1	0.071	0.266	0.58	165	71	71
B-2	0.060	0.245	0.49	180	71	71
B-2	0.070	0.265	0.57	179	72	72
B-3	0.069	0.263	0.51	165	72	72
B-3	0.070	0.265	0.57	168	72	73
C-1	0.070	0.265	0.57	160	72	73
C-1	0.061	0.247	0.50	178	72	73
C-2	0.085	0.292	0.70	174	72	72
C-2	0.079	0.281	0.65	168	73	73
C-3	0.069	0.263	0.51	170	72	72
C-3	0.070	0.265	0.57	168	71	71
D-1	0.070	0.265	0.57	170	70	71
D-1	0.061	0.247	0.50	170	72	72
D-2	0.070	0.265	0.57	182	71	72
D-2	0.060	0.245	0.49	162	70	71
D-3	0.070	0.265	0.57	170	70	71
D-3	0.070	0.265	0.57	172	70	71
Average	0.07	0.268	0.58	171.6		69.5

Initial volume	281.157	ft^3	Initial volume	0.000	liters
Final volume	333.305	ft^3	Final volume	0.000	liters
Total metered	52.148	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	800.8	557.1	243.7			0.0
2	605.9	600.4	5.5			0.0
3	746.1	737.6	8.5			0.0
4	798.3	780.7	17.6			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2951.1	2675.8	275.3	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:	Oct. 28, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Quench Tower		Test Start Time:	6:33 AM	
Unit Operation:	Normal		Test Finish Time:	2:33 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:	1936		CO + N2	79.14	% dv
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	0.998		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	120	minutes	Water Collected (W_f - W_i)	263.1	g
Barometric Pressure (Pbar)	29.39	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	12.405	scf
Stack Static Pressure (Pg)	0.10	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	12.405	scf
Stack Diameter (Ds) (L if rectangular)	600	inches	Volume Dry Gas Metered (Vm)	54.737	dacf
Stack Width (enter NA if circular)	216	inches	Vol. Dry Gas Metered Stand.(Vm(std))	53.234	dscf
Nozzle Diameter (Dn) (NA if NA)	0.337	inches	Volume Dry Gas Metered (Vm(m^3))	1.550	dacm
O2	20.82	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.507	dscm
CO2	0.03	% dv	Stack Absolute Pressure (Ps)	29.40	in. Hg
Product Rate (enter NA if not needed)	NA	input ton/hr	Stack Absolute Temperature (Tsavg)	634.6	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	13.66	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	0.4648	vol. fraction
Sample Calculation Title	Particulate and CEMS		H2O in the gas from test data (Bws)	0.1890	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)	0.1890	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	26.79	lb/lb-mole
Calculations			Gas Velocity (Vs)	17.62	ft/s
Meter Temperature (Tm)	73.2	F	Is the stack circular or rectangular?	RECTANGULAR	
Stack Temperature (Tsavg)	174.9	F	Area Stack (As)	900.00	ft^2
Orifice Pressure Drop (dHavg)	0.618	in. H_2O	Actual Gas Flowrate	951,239	acfm
GasVelocity Head ($dP)^{1/2}$avg	0.2733	in. H_2O^1/2	Standard Gas Flowrate	777,155	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	630,280	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	26,936	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	22,007	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	17,848	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000619	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	102.3	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	8.00	hours			
# of Quenches	24	Quenches/test			
Avg. # of Quenches per hour	3.30	Quenches/hour			
Minutes per Quench	5.00	minutes/Quench			

FILTERABLE PARTICULATE (METHOD 5)

Acetone Wash Particulate (Blank Corrected)	148.43	mg
Filter Particulate	10.35	mg
Total Filterable Particulate Mass (m_n)	158.78	mg
Emission Concentration	0.0459	gr/dscf
Emission Concentration	105.33	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

CONDENSABLE PARTICULATE (METHOD 202)

Inorganic Particulate Mass (m_n)	9.40	mg
Condensable Inorganic Concentration (Uncorrec	6.234	mg/dscm
Organic Particulate Mass (m_n)	2.85	mg
Condensable Organic Concentration (Uncorrecte	1.891	mg/dscm
Total Condensable Particulate Mass (m_n) (Blank	11.65	mg
Emission Concentration	0.0034	gr/dscf
Emission Concentration	7.728	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

TOTAL PARTICULATE (METHODS 5/202)

Total Particulate Mass (m_n)	170.43	mg
Emission Concentration	0.0493	gr/dscf
Emission Concentration	113.06	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

ArcelorMittal Quench Tower **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	0.060	0.245	0.49	173	69	70
A-1	0.071	0.266	0.58	180	69	69
A-2	0.065	0.255	0.53	159	69	69
A-2	0.075	0.274	0.62	172	70	69
A-3	0.080	0.283	0.66	182	71	70
A-3	0.077	0.277	0.63	174	73	72
B-1	0.075	0.274	0.62	188	73	72
B-1	0.081	0.285	0.66	171	74	72
B-2	0.073	0.270	0.62	177	75	73
B-2	0.084	0.290	0.69	185	75	74
B-3	0.080	0.283	0.66	169	75	75
B-3	0.071	0.266	0.58	174	74	74
C-1	0.073	0.270	0.62	169	74	74
C-1	0.080	0.283	0.66	176	73	73
C-2	0.073	0.270	0.62	172	73	73
C-2	0.085	0.292	0.70	179	74	73
C-3	0.073	0.270	0.60	168	74	74
C-3	0.075	0.274	0.62	172	74	73
D-1	0.074	0.272	0.61	176	74	74
D-1	0.067	0.259	0.55	167	75	74
D-2	0.073	0.270	0.62	184	76	75
D-2	0.082	0.286	0.67	178	76	75
D-3	0.071	0.266	0.58	171	76	76
D-3	0.077	0.277	0.63	182	77	76
Average	0.07	0.273	0.62	174.9		73.2

Initial volume	333.647	ft^3	Initial volume	0.000	liters
Final volume	388.384	ft^3	Final volume	0.000	liters
Total metered	54.737	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	790.6	547.9	242.7			0.0
2	615.6	616.8	-1.2			0.0
3	708.1	702.5	5.6			0.0
4	771.2	755.2	16.0			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	2885.5	2622.4	263.1	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal		Test Date:	Oct. 31, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Quench Tower		Test Start Time:	9:37 AM	
Unit Operation:	Normal		Test Finish Time:	7:15 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1936		CO + N2	79.10	% dv
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	0.998		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	120	minutes	Water Collected (W_f - W_i)	269.8	g
Barometric Pressure (Pbar)	29.52	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	12.721	scf
Stack Static Pressure (Pg)	0.01	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	12.721	scf
Stack Diameter (Ds) (L if rectangular)	600	inches	Volume Dry Gas Metered (Vm)	54.732	dacf
Stack Width (enter NA if circular)	216	inches	Vol. Dry Gas Metered Stand.(Vm(std))	53.837	dscf
Nozzle Diameter (Dn) (NA if NA)	0.337	inches	Volume Dry Gas Metered (Vm(m^3))	1.550	dacm
O2	20.79	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.524	dscm
CO2	0.11	% dv	Stack Absolute Pressure (Ps)	29.52	in. Hg
Product Rate (enter NA if not needed)	NA	input ton/hr	Stack Absolute Temperature (Tsavg)	637.1	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	14.47	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	0.4900	vol. fraction
Sample Calculation Title	Particulate and CEMS		H2O in the gas from test data (Bws)	0.1911	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)	0.1911	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	28.85	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	26.78	lb/lb-mole
Calculations			Gas Velocity (Vs)	17.66	ft/s
Meter Temperature (Tm)	69.5	F	Is the stack circular or rectangular?	RECTANGULAR	
Stack Temperature (Tsavg)	177.5	F	Area Stack (As)	900.00	ft^2
Orifice Pressure Drop (dHavg)	0.621	in. H_2O	Actual Gas Flowrate	953,451	acfm
GasVelocity Head (dP)^avg	0.2739	in. H_2O^1/2	Standard Gas Flowrate	779,111	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	630,201	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	26,999	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	22,062	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	17,845	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000619	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	103.4	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	9.63	hours			
# of Quenches	24	Quenches/test			
Avg. # of Quenches per hour	3.30	Quenches/hour			
Minutes per Quench	5.00	minutes/Quench			

FILTERABLE PARTICULATE (METHOD 5)

Acetone Wash Particulate (Blank Corrected)	39.95	mg
Filter Particulate	16.20	mg
Total Filterable Particulate Mass (m_n)	56.15	mg
Emission Concentration	0.0161	gr/dscf
Emission Concentration	36.83	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

CONDENSABLE PARTICULATE (METHOD 202)

Inorganic Particulate Mass (m_n)	8.11	mg
Condensable Inorganic Concentration (Uncorrec	5.318	mg/dscm
Organic Particulate Mass (m_n)	1.55	mg
Condensable Organic Concentration (Uncorrecte	1.017	mg/dscm
Total Condensable Particulate Mass (m_n) (Blank	9.06	mg
Emission Concentration	0.0026	gr/dscf
Emission Concentration	5.943	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

TOTAL PARTICULATE (METHODS 5/202)

Total Particulate Mass (m_n)	65.21	mg
Emission Concentration	0.0187	gr/dscf
Emission Concentration	42.77	mg/dscm
Emission Rate	NA	lb/Quench
Emission Rate	NA	lb/hr

ArcelorMittal Run 3 — **Quench Tower** — **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	0.071	0.266	0.58	177	65	63
A-1	0.077	0.277	0.62	181	65	63
A-2	0.083	0.288	0.67	175	66	64
A-2	0.079	0.281	0.64	180	67	65
A-3	0.074	0.272	0.60	183	67	66
A-3	0.080	0.283	0.65	174	68	67
B-1	0.078	0.279	0.63	176	68	67
B-1	0.073	0.270	0.59	185	69	68
B-2	0.083	0.288	0.67	184	69	68
B-2	0.078	0.279	0.64	176	70	69
B-3	0.084	0.290	0.69	172	71	71
B-3	0.076	0.276	0.62	178	72	71
C-1	0.077	0.277	0.63	183	73	72
C-1	0.071	0.266	0.58	177	73	73
C-2	0.075	0.274	0.61	174	74	74
C-2	0.069	0.263	0.57	181	75	74
C-3	0.075	0.274	0.61	175	73	73
C-3	0.078	0.279	0.64	176	72	71
D-1	0.068	0.261	0.56	171	69	69
D-1	0.077	0.277	0.63	182	70	70
D-2	0.081	0.285	0.66	174	70	71
D-2	0.076	0.276	0.62	172	70	69
D-3	0.071	0.266	0.58	180	71	69
D-3	0.050	0.224	0.61	173	71	70
Average	0.08	0.274	0.62	177.5		69.5

Initial volume	388.702	ft^3	Initial volume	0.000	liters
Final volume	443.434	ft^3	Final volume	0.000	liters
Total metered	54.732	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	800.9	551.5	249.4			0.0
2	618.0	619.2	-1.2			0.0
3	712.9	707.3	5.6			0.0
4	769.9	753.9	16.0			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	2901.7	2631.9	269.8	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

MONTROSE METHOD 5/202 DATA SHEET

Client:	Arcelormittal	Test Type:	Method 5/202	Meter ΔH :	1.830	Start Time:	21:17
Date:	10/27/16 - 10/28/16	Run Number:	1	Meter Correction (γ):	0.998	Stop Time:	~~[illegible]~~ 5:50
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.337	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	+0.1	Control Box ID:	1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.52	Assumed Moisture (%):	20	Pitot ID:	9-6
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	37	Umbilical Length (Feet):	200	Filter ID:	7187
Test Crew:	JV JW TL TM CB	Initial K-factor	8.2			Stack Diameter (inches):	600 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Clock Time (mins)	Metered Volume (ft³) 281.157	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°	CPM Temp. (°F) 65 - 85°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:05:00	21:17	282.671	.085	0.697	2	180	249	248	55	55	63	64	
A-1	0:10:00	21:30	284.029	.085	0.697	2	180	248	248	52	50	63	64	
A-2	0:15:00	21:42	285.816	.079	0.65	2	179	249	248	51	50	64	64	
A-2	0:20:00	21:56	289.201	.069	0.57	2	167	248	248	50	51	64	64	
A-3	0:25:00	22:06	291.407	.085	0.697	3	173	248	248	50	53	64	65	
A-3	0:30:00	22:22	294.016	.085	0.697	3	170	248	248	50	50	64	67	
B-1	0:35:00	23:57	296.402	0.069	0.51	2	169	248	248	52	54	64	67	
B-1	0:40:00	00:08	298.010	0.071	0.58	2	165	248	248	45	53	71	71	
B-2	0:45:00	00:22	301.068	0.060	0.49	2	180	248	248	46	53	71	71	
B-2	0:50:00	00:35	303.124	0.070	0.57	2	179	248	247	47	52	72	72	
B-3	0:55:00	00:53	305.421	0.069	0.51	2	165	248	247	47	51	72	72	
B-3	1:00:00	1:05	307.477	0.070	0.57	2	168	248	248	48	50	72	73	
C-1	1:05:00	1:57	309.841	0.070	0.57	2	160	248	245	48	50	72	73	
C-1	1:10:00	2:12	312.008	0.061	0.50	2	178	248	248	50	48	72	73	
C-2	1:15:00	2:23	314.219	0.085	0.70	2	174	248	247	49	50	72	72	
C-2	1:20:00	2:52	316.562	0.079	0.65	2	168	247	246	52	53	73	73	
C-3	1:25:00	3:17	318.671	0.069	0.51	2	170	247	245	52	50	72	72	
C-3	1:30:00	3:32	320.676	0.070	0.57	2	168	248	245	50	49	71	71	
D-1	1:35:00	4:20	323.011	0.070	0.57	2	170	248	248	50	50	70	71	
D-1	1:40:00	4:35	325.241	0.061	0.50	2	170	248	248	49	50	72	72	
D-2	1:45:00	4:46	327.274	0.070	0.57	2	182	248	248	47	51	71	72	
D-2	1:50:00	4:58	329.266	0.060	0.49	2	162	248	248	48	52	70	71	
D-3	1:55:00	5:25	331.214	0.070	0.57	2	170	248	248	49	51	70	71	
D-3	2:00:00	5:50	333.305	0.070	0.57	2	172	248	248	49	50	70	71	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	0.002	11
Check	Final	5	0.000

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

Fyrite Kit ID: NA Fyrite O_2 Check NA

		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0" & stable for 15 sec)

Balance ID: BAL-017
Ref. Weight (200g): NA (± 0.5g)
Ref. Weight (500g): 500.0 (± 0.5g)

Imp	Contents	Final	Initial	Difference	H_2O Added
1	Empty (g)	800.8	557.1		
2	Empty (g)	605.9	600.4		
3	H_2O (g)	746.1	737.6		
4	Silica (g)	798.3	780.7		

Purge Time	Purge Rate (lpm)	CPM Temp (°F)
15	20	65
30	20	66
45	20	66
60	20	67

MONTROSE METHOD 5/202 DATA SHEET

Client:	Arcelormittal	Test Type:	Method 5/202	Meter ΔH :	1.830	Start Time:	06:33
Date:	10/28/16 - 10/28/16	Run Number:	2	Meter Correction (γ):	0.998	Stop Time:	14:33
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.337	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	.01	Control Box ID:	MB 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	SW ~~29.47~~ 29.39	Assumed Moisture (%):	20	Pitot ID:	9-6
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	50	Umbilical Length (Feet):	200	Filter ID:	7215
Test Crew:	JV JW TL TM CB	Initial K-factor	8.2			Stack Diameter (inches):	600 · 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Clock Time (mins)	Metered Volume (ft³) 333.647	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°	CPM Temp. (°F) 65 - 85°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:05:00	6:33	335.900	.060	0.49	2	173	247	248	43	44	69	70	
A-1	0:10:00	6:52	338.021	.071	0.58	2	160	250	248	40	43	69	69	
A-2	0:15:00	7:02	340.07	.065	0.53	2	159	248	248	40	42	69	69	
A-2	0:20:00	~~7:24~~ 7:43	342.462	.075	.62	2	172	248	248	42	43	70	69	
A-3	0:25:00	8:15	344.80	.080	.66	2	182	248	248	44	48	71	70	
A-3	0:30:00	8:32	347.00	.077	.63	2	174	247	247	47	59	73	72	
B-1	0:35:00	8:45	349.27	.075	.62	2	188	248	248	48	66	73	72	
B-1	0:40:00	9:02	351.157	.081	.66	2	171	248	247	48	69	74	72	
B-2	0:45:00	9:25	353.68	.075	.62	2	177	247	248	48	71	75	73	
B-2	0:50:00	10:08	356.32	.084	.69	2	185	247	248	48	70	75	74	
B-3	0:55:00	10:35	358.68	.080	.66	2	169	248	247	49	68	75	75	
B-3	1:00:00	10:49	360.902	.071	.58	2	174	248	248	52	66	74	74	
C-1	1:05:00	11:10	363.16	.076	.62	2	169	247	249	54	68	74	74	
C-1	1:10:00	11:26	365.53	.080	.66	2	176	248	247	54	67	73	73	
C-2	1:15:00	11:40	367.82	.076	.62	2	172	249	248	54	67	73	73	
C-2	1:20:00	11:53	770.197	.085	.70	2	179	249	247	53	65	74	73	
C-3	1:25:00	12:47	372.[illegible]	.073	.60	2	168	249	249	52	65	74	74	
C-3	1:30:00	13:01	374.70	.075	.62	2	172	248	248	51	71	74	73	
D-1	1:35:00	13:15	377.01	.074	.61	2	176	248	248	49	69	74	74	
D-1	1:40:00	13:29	379.192	.067	.55	2	167	247	248	50	67	75	74	
D-2	1:45:00	13:52	381.49	.076	.62	2	184	247	248	50	66	76	75	
D-2	1:50:00	14:05	383.86	.082	.67	2	178	247	247	52	65	76	75	
D-3	1:55:00	14:20	386.04	.071	.58	2	171	247	247	51	68	76	76	
D-3	2:00:00	14:33	388.384	.077	.63	2	182	247	248	52	66	77	76	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	4	0.000

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

Fyrite Kit ID: NA Fyrite O_2 Check NA

		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0" & stable for 15 sec)

Balance ID: BAL-017
Ref. Weight (200g): NA (± 0.5g)
Ref. Weight (500g): 500.0 (± 0.5g)

Imp	Contents	Final	Initial	Difference	H_2O Added
1	Empty (g)	790.6	547.9		
2	Empty (g)	615.6	616.8		
3	H_2O (g)	208.1	202.5		
4	Silica (g)	771.2	755.2		

Purge Time	Purge Rate (lpm)	CPM Temp (°F)
15	20	67
30	20	67
45	20	68
60	20	68

Page 1 of 1

MONTROSE METHOD 5/202 DATA SHEET

Client:	Arcelormittal	**Test Type:**	Method 5/202	**Meter ΔH :**	1.830	**Start Time:**	09:37
Date:	10-31-16	**Run Number:**	3	**Meter Correction (γ):**	0.998	**Stop Time:**	07:15
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.337	**Pitot Correction:**	0.84	**T/C ID:**	9-6
Sampling Location:	Quench Tower Outlet	**Static Press (in. H_2O):**	0.01	**Control Box ID:**	MB 1936	**Probe ID:**	9-6
		Baro. Pres. (in. Hg):	29.92	**Assumed Moisture (%):**	20	**Pitot ID:**	9-6
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	37	**Umbilical Length (Feet):**	200	**Filter ID:**	7193
Test Crew:	JV JW TL TM CB	**Initial K-factor**	8.1 *8.2			**Stack Diameter (inches):**	300 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Clock Time (mins)	Metered Volume (ft³) 388.702	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°	CPM Temp. (°F) 65 - 85°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:05:00	09:49	390.89	.071	.58	1	177	240	249	41	67	65	67	
A-1	0:10:00	10:02	393.16	.077	.62	1	181	242	248	41	67	65	63	
A-2	0:15:00	10:52	395.47	.083	.67	1	175	252	248	43	66	66	64	
A-2	0:20:00	11:07	397.807	.079	.64	1	180	244	248	46	72	67	65	
A-3	0:25:00	11:29	400.05	.074	.60	1	183	254	248	48	69	67	66	
A-3	0:30:00	11:43	402.37	.080	.65	1	174	245	247	47	67	68	67	
B-1	0:35:00	11:57	404.65	.078	.63	1	176	240	248	48	73	68	67	
B-1	0:40:00	12:12	406.848	.073	.59	1	185	245	248	48	71	69	68	
B-2	0:45:00	12:39	409.30	.083	.67	1	184	250	248	48	68	69	68	
B-2	0:50:00	13:33	411.60	.078	.64	1	176	240	248	48	67	70	69	*8.2
B-3	0:55:00	13:46	414.01	.084	.69	1	172	245	247	49	74	71	71	
B-3	1:00:00	14:00	416.308	.076	.62	1	178	245	248	48	71	72	71	
C-1	1:05:00	14:20	418.60	.077	.63	1	183	237	246	51	73	73	72	
C-1	1:10:00	14:36	420.83	.071	.58	1	177	241	248	50	71	73	73	
C-2	1:15:00	14:49	423.15	.075	.61	1	174	246	248	51	69	74	74	
C-2	1:20:00	15:03	425.327	.069	.57	1	181	239	248	54	66	75	74	
C-3	1:25:00	15:59	427.58	.075	.61	1	175	247	246	54	65	73	73	
C-3	1:30:00	16:39	429.88	.078	.64	1	176	254	248	54	65	72	71	
D-1	1:35:00	16:54	432.05	.068	.56	1	171	241	248	56	73	69	69	
D-1	1:40:00	17:13	434.317	.077	.63	1	182	248	248	54	68	70	70	
D-2	1:45:00	17:36	436.67	.081	.66	1	174	253	247	55	72	70	71	
D-2	1:50:00	18:11	438.95	.076	.62	1	172	244	248	55	71	70	69	
D-3	1:55:00	18:25	441.18	.071	.58	1	180	256	249	53	73	71	69	
D-3	2:00:00	18:40	443.434	.05	.61	1	173	245	248	54	70	71	70	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.010
Check	Final	3	0.003

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

Fyrite Kit ID: NA Fyrite O_2 Check NA

		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0" & stable for 15 sec)

Balance ID: BAL017
Ref. Weight (200g): NA (± 0.5g)
Ref. Weight (500g): 500.0 (± 0.5g)

Imp	Contents	Final	Initial	Difference	H_2O Added
1	Empty (g)	800.9	551.5		0
2	Empty (g)	618.0	619.2		
3	H_2O (g)	712.9	707.3		
4	Silica (g)	769.9	753.9		

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

* changed K-Factor @ B-2

Method 5/29

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/27	21:17:01	20.44	0.19
2	2016/10/27	21:18:01	20.43	0.19
3	2016/10/27	21:19:01	20.55	0.10
4	2016/10/27	21:20:01	20.55	0.10
5	2016/10/27	21:30:01	20.40	0.23
6	2016/10/27	21:31:01	20.22	0.38
7	2016/10/27	21:32:01	20.51	0.13
8	2016/10/27	21:33:01	20.54	0.10
9	2016/10/27	21:42:01	20.52	0.13
10	2016/10/27	21:43:01	20.32	0.28
11	2016/10/27	21:44:01	20.52	0.12
12	2016/10/27	21:45:01	20.53	0.11
13	2016/10/27	21:54:01	20.34	0.27
14	2016/10/27	21:55:01	20.25	0.33
15	2016/10/27	21:56:01	20.48	0.13
16	2016/10/27	21:57:01	20.50	0.11
17	2016/10/27	22:07:01	20.27	0.32
18	2016/10/27	22:08:01	20.49	0.13
19	2016/10/27	22:09:01	20.50	0.11
20	2016/10/27	22:10:01	20.50	0.11
21	2016/10/27	22:17:01	20.49	0.12
22	2016/10/27	22:18:01	20.48	0.11
23	2016/10/27	22:19:01	20.13	0.40
24	2016/10/27	22:20:01	20.41	0.17
25	2016/10/27	22:46:01	20.44	0.14
26	2016/10/27	22:47:01	20.23	0.30
27	2016/10/27	22:48:01	20.43	0.14
28	2016/10/27	22:49:01	20.44	0.13
29	2016/10/27	22:59:01	20.25	0.29
30	2016/10/27	23:00:01	20.40	0.16
31	2016/10/27	23:01:01	20.44	0.13
32	2016/10/27	23:02:01	20.44	0.13
33	2016/10/27	23:42:01	20.30	0.22
34	2016/10/27	23:43:01	20.37	0.14
35	2016/10/27	23:44:01	20.43	0.08
36	2016/10/27	23:45:01	20.43	0.08
37	2016/10/27	23:52:01	20.43	0.07
38	2016/10/27	23:53:01	20.21	0.24
39	2016/10/27	23:54:01	20.39	0.10
40	2016/10/27	23:55:01	20.42	0.08
41	2016/10/28	00:06:01	20.39	0.10
42	2016/10/28	00:07:01	20.21	0.24
43	2016/10/28	00:08:01	20.40	0.10
44	2016/10/28	00:09:01	20.41	0.08
45	2016/10/28	00:21:01	20.27	0.20
46	2016/10/28	00:22:01	20.34	0.13
47	2016/10/28	00:23:01	20.40	0.09
48	2016/10/28	00:24:01	20.40	0.08
49	2016/10/28	00:35:01	20.25	0.21

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
50	2016/10/28	00:36:01	20.30	0.16
51	2016/10/28	00:37:01	20.39	0.09
52	2016/10/28	00:38:01	20.39	0.08
53	2016/10/28	00:53:01	20.24	0.21
54	2016/10/28	00:54:01	20.31	0.14
55	2016/10/28	00:55:01	20.38	0.09
56	2016/10/28	00:56:01	20.38	0.08
57	2016/10/28	01:06:01	20.31	0.15
58	2016/10/28	01:07:01	20.30	0.14
59	2016/10/28	01:08:01	20.38	0.08
60	2016/10/28	01:09:01	20.38	0.08
61	2016/10/28	01:46:01	20.19	0.25
62	2016/10/28	01:47:01	20.35	0.11
63	2016/10/28	01:48:01	20.38	0.09
64	2016/10/28	01:49:01	20.38	0.09
65	2016/10/28	01:59:01	20.17	0.26
66	2016/10/28	02:00:01	20.36	0.10
67	2016/10/28	02:01:01	20.37	0.09
68	2016/10/28	02:02:01	20.37	0.09
69	2016/10/28	02:11:01	20.24	0.21
70	2016/10/28	02:12:01	20.30	0.14
71	2016/10/28	02:13:01	20.37	0.09
72	2016/10/28	02:14:01	20.37	0.09
73	2016/10/28	02:25:01	20.16	0.25
74	2016/10/28	02:26:01	20.35	0.10
75	2016/10/28	02:27:01	20.36	0.09
76	2016/10/28	02:28:01	20.36	0.09
77	2016/10/28	02:36:01	20.24	0.19
78	2016/10/28	02:37:01	20.30	0.14
79	2016/10/28	02:38:01	20.37	0.09
80	2016/10/28	02:39:01	20.37	0.09
81	2016/10/28	02:50:01	20.19	0.23
82	2016/10/28	02:51:01	20.33	0.11
83	2016/10/28	02:52:01	20.36	0.09
84	2016/10/28	02:53:01	20.36	0.09
85	2016/10/28	03:04:01	20.15	0.27
86	2016/10/28	03:05:01	20.33	0.12
87	2016/10/28	03:06:01	20.37	0.09
88	2016/10/28	03:07:01	20.37	0.09
89	2016/10/28	03:18:01	20.12	0.25
90	2016/10/28	03:19:01	20.34	0.10
91	2016/10/28	03:20:01	20.36	0.09
92	2016/10/28	03:21:01	20.37	0.09
93	2016/10/28	03:32:01	20.36	0.10
94	2016/10/28	03:33:01	20.16	0.26
95	2016/10/28	03:34:01	20.36	0.10
96	2016/10/28	03:35:01	20.37	0.09
97	2016/10/28	04:22:01	20.15	0.23
98	2016/10/28	04:23:01	20.33	0.11
99	2016/10/28	04:24:01	20.36	0.10

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
100	2016/10/28	04:25:01	20.36	0.09
101	2016/10/28	04:35:01	20.25	0.20
102	2016/10/28	04:36:01	20.25	0.17
103	2016/10/28	04:37:01	20.36	0.10
104	2016/10/28	04:38:01	20.36	0.10
105	2016/10/28	04:46:01	20.32	0.14
106	2016/10/28	04:47:01	20.19	0.24
107	2016/10/28	04:48:01	20.35	0.10
108	2016/10/28	04:49:01	20.36	0.10
109	2016/10/28	04:58:01	20.33	0.13
110	2016/10/28	04:59:01	20.20	0.22
111	2016/10/28	05:00:01	20.35	0.10
112	2016/10/28	05:01:01	20.36	0.10
113	2016/10/28	05:11:01	20.16	0.28
114	2016/10/28	05:12:01	20.32	0.13
115	2016/10/28	05:13:01	20.36	0.10
116	2016/10/28	05:14:01	20.36	0.10
117	2016/10/28	05:24:01	20.29	0.17
118	2016/10/28	05:25:01	20.25	0.18
119	2016/10/28	05:26:01	20.37	0.10
120	2016/10/28	05:27:01	20.37	0.10
	Run 1 Average		**20.35**	**0.15**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/28	06:34:01	20.19	0.28
2	2016/10/28	06:35:01	20.35	0.13
3	2016/10/28	06:36:01	20.39	0.11
4	2016/10/28	06:37:01	20.39	0.10
5	2016/10/28	06:53:01	20.23	0.22
6	2016/10/28	06:54:01	20.36	0.12
7	2016/10/28	06:55:01	20.40	0.10
8	2016/10/28	06:56:01	20.41	0.10
9	2016/10/28	07:04:01	20.24	0.26
10	2016/10/28	07:05:01	20.40	0.12
11	2016/10/28	07:06:01	20.43	0.10
12	2016/10/28	07:07:01	20.43	0.10
13	2016/10/28	07:19:01	20.36	0.18
14	2016/10/28	07:20:01	20.26	0.24
15	2016/10/28	07:21:01	20.43	0.11
16	2016/10/28	07:22:01	20.44	0.11
17	2016/10/28	07:41:01	20.27	0.23
18	2016/10/28	07:42:01	20.45	0.11
19	2016/10/28	07:43:01	20.46	0.11
20	2016/10/28	07:44:01	20.46	0.11
21	2016/10/28	08:04:01	20.31	0.23
22	2016/10/28	08:05:01	20.43	0.12
23	2016/10/28	08:06:01	20.47	0.11
24	2016/10/28	08:07:01	20.47	0.10
25	2016/10/28	08:15:01	20.26	0.28
26	2016/10/28	08:16:01	20.44	0.12
27	2016/10/28	08:17:01	20.47	0.10
28	2016/10/28	08:18:01	20.46	0.10
29	2016/10/28	08:31:01	20.55	0.22
30	2016/10/28	08:32:01	20.63	0.14
31	2016/10/28	08:33:01	20.68	0.10
32	2016/10/28	08:34:01	20.69	0.10
33	2016/10/28	08:44:01	20.52	0.26
34	2016/10/28	08:45:01	20.68	0.11
35	2016/10/28	08:46:01	20.70	0.10
36	2016/10/28	08:47:01	20.70	0.10
37	2016/10/28	09:00:01	20.51	0.25
38	2016/10/28	09:01:01	20.69	0.10
39	2016/10/28	09:02:01	20.71	0.10
40	2016/10/28	09:03:01	20.71	0.10
41	2016/10/28	09:12:01	20.61	0.18
42	2016/10/28	09:13:01	20.62	0.17
43	2016/10/28	09:14:01	20.70	0.10
44	2016/10/28	09:15:01	20.71	0.10
45	2016/10/28	09:25:01	20.55	0.24
46	2016/10/28	09:26:01	20.70	0.11
47	2016/10/28	09:27:01	20.71	0.10
48	2016/10/28	09:28:01	20.72	0.10
49	2016/10/28	10:08:01	20.65	0.15

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
50	2016/10/28	10:09:01	20.61	0.16
51	2016/10/28	10:10:01	20.70	0.10
52	2016/10/28	10:11:01	20.71	0.10
53	2016/10/28	10:33:01	20.52	0.26
54	2016/10/28	10:34:01	20.68	0.11
55	2016/10/28	10:35:01	20.70	0.10
56	2016/10/28	10:36:01	20.71	0.10
57	2016/10/28	10:46:01	20.52	0.26
58	2016/10/28	10:47:01	20.66	0.13
59	2016/10/28	10:48:01	20.69	0.10
60	2016/10/28	10:49:01	20.70	0.10
61	2016/10/28	10:59:01	20.55	0.21
62	2016/10/28	11:00:01	20.68	0.11
63	2016/10/28	11:01:01	20.70	0.10
64	2016/10/28	11:02:01	20.71	0.10
65	2016/10/28	11:10:01	20.52	0.24
66	2016/10/28	11:11:01	20.68	0.11
67	2016/10/28	11:12:01	20.70	0.10
68	2016/10/28	11:13:01	20.70	0.10
69	2016/10/28	11:25:01	20.55	0.20
70	2016/10/28	11:26:01	20.69	0.10
71	2016/10/28	11:27:01	20.70	0.10
72	2016/10/28	11:28:01	20.71	0.10
73	2016/10/28	11:38:01	20.57	0.22
74	2016/10/28	11:39:01	20.66	0.13
75	2016/10/28	11:40:01	20.70	0.10
76	2016/10/28	11:41:01	20.70	0.10
77	2016/10/28	11:51:01	20.54	0.20
78	2016/10/28	11:52:01	20.69	0.10
79	2016/10/28	11:53:01	20.70	0.10
80	2016/10/28	11:54:01	20.70	0.10
81	2016/10/28	12:05:01	20.50	0.28
82	2016/10/28	12:06:01	20.68	0.11
83	2016/10/28	12:07:01	20.70	0.10
84	2016/10/28	12:08:01	20.70	0.10
85	2016/10/28	12:47:01	20.60	0.18
86	2016/10/28	12:48:01	20.60	0.16
87	2016/10/28	12:49:01	20.68	0.10
88	2016/10/28	12:50:01	20.69	0.10
89	2016/10/28	13:01:01	20.49	0.26
90	2016/10/28	13:02:01	20.66	0.11
91	2016/10/28	13:03:01	20.68	0.10
92	2016/10/28	13:04:01	20.68	0.10
93	2016/10/28	13:13:01	20.48	0.28
94	2016/10/28	13:14:01	20.64	0.13
95	2016/10/28	13:15:01	20.67	0.10
96	2016/10/28	13:16:01	20.67	0.10
97	2016/10/28	13:26:01	20.46	0.26
98	2016/10/28	13:27:01	20.65	0.10
99	2016/10/28	13:28:01	20.67	0.10

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
100	2016/10/28	13:29:01	20.67	0.10
101	2016/10/28	13:38:01	20.47	0.25
102	2016/10/28	13:39:01	20.64	0.10
103	2016/10/28	13:40:01	20.66	0.10
104	2016/10/28	13:41:01	20.66	0.10
105	2016/10/28	13:52:01	20.65	0.10
106	2016/10/28	13:53:01	20.49	0.22
107	2016/10/28	13:54:01	20.64	0.10
108	2016/10/28	13:55:01	20.65	0.09
109	2016/10/28	14:04:01	20.49	0.24
110	2016/10/28	14:05:01	20.61	0.11
111	2016/10/28	14:06:01	20.64	0.09
112	2016/10/28	14:07:01	20.65	0.09
113	2016/10/28	14:17:01	20.47	0.26
114	2016/10/28	14:18:01	20.60	0.12
115	2016/10/28	14:19:01	20.64	0.09
116	2016/10/28	14:20:01	20.65	0.09
117	2016/10/28	14:30:01	20.48	0.24
118	2016/10/28	14:31:01	20.63	0.09
119	2016/10/28	14:32:01	20.65	0.09
120	2016/10/28	14:33:01	20.65	0.09
	Run 2 Averages		**20.58**	**0.14**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/31	09:38:01	20.60	0.23
2	2016/10/31	09:39:01	20.67	0.17
3	2016/10/31	09:40:01	20.73	0.13
4	2016/10/31	09:41:01	20.73	0.13
5	2016/10/31	10:00:01	20.73	0.13
6	2016/10/31	10:01:01	20.56	0.26
7	2016/10/31	10:02:01	20.64	0.19
8	2016/10/31	10:03:01	20.71	0.13
9	2016/10/31	10:50:01	20.55	0.27
10	2016/10/31	10:51:01	20.62	0.20
11	2016/10/31	10:52:01	20.70	0.13
12	2016/10/31	10:53:01	20.70	0.13
13	2016/10/31	11:03:01	20.45	0.38
14	2016/10/31	11:04:01	20.58	0.25
15	2016/10/31	11:05:01	20.70	0.13
16	2016/10/31	11:06:01	20.72	0.13
17	2016/10/31	11:15:01	20.36	0.44
18	2016/10/31	11:16:01	20.53	0.28
19	2016/10/31	11:17:01	20.69	0.14
20	2016/10/31	11:18:01	20.69	0.13
21	2016/10/31	11:29:01	20.34	0.46
22	2016/10/31	11:30:01	20.53	0.29
23	2016/10/31	11:31:01	20.70	0.14
24	2016/10/31	11:32:01	20.71	0.14
25	2016/10/31	11:41:01	20.43	0.39
26	2016/10/31	11:42:01	20.56	0.26
27	2016/10/31	11:43:01	20.70	0.14
28	2016/10/31	11:44:01	20.71	0.13
29	2016/10/31	11:55:01	20.47	0.32
30	2016/10/31	11:56:01	20.58	0.22
31	2016/10/31	11:57:01	20.68	0.13
32	2016/10/31	11:58:01	20.69	0.13
33	2016/10/31	12:08:01	20.69	0.13
34	2016/10/31	12:09:01	20.60	0.20
35	2016/10/31	12:10:01	20.62	0.17
36	2016/10/31	12:11:01	20.66	0.13
37	2016/10/31	12:25:01	20.48	0.28
38	2016/10/31	12:26:01	20.57	0.20
39	2016/10/31	12:27:01	20.66	0.13
40	2016/10/31	12:28:01	20.68	0.13
41	2016/10/31	12:38:01	20.52	0.29
42	2016/10/31	12:39:01	20.58	0.22
43	2016/10/31	12:40:01	20.66	0.14
44	2016/10/31	12:41:01	20.68	0.13
45	2016/10/31	13:32:01	20.28	0.40
46	2016/10/31	13:33:01	20.40	0.29
47	2016/10/31	13:34:01	20.59	0.13
48	2016/10/31	13:35:01	20.63	0.11
49	2016/10/31	13:44:01	20.36	0.37

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
50	2016/10/31	13:45:01	20.48	0.24
51	2016/10/31	13:46:01	20.61	0.13
52	2016/10/31	13:47:01	20.63	0.12
53	2016/10/31	13:56:01	20.47	0.29
54	2016/10/31	13:57:01	20.48	0.26
55	2016/10/31	13:58:01	20.58	0.16
56	2016/10/31	13:59:01	20.62	0.13
57	2016/10/31	14:09:01	20.41	0.34
58	2016/10/31	14:10:01	20.50	0.24
59	2016/10/31	14:11:01	20.60	0.14
60	2016/10/31	14:12:01	20.61	0.13
61	2016/10/31	14:20:01	20.37	0.37
62	2016/10/31	14:21:01	20.48	0.26
63	2016/10/31	14:22:01	20.60	0.14
64	2016/10/31	14:23:01	20.62	0.13
65	2016/10/31	14:35:01	20.53	0.17
66	2016/10/31	14:36:01	20.57	0.15
67	2016/10/31	14:37:01	20.60	0.13
68	2016/10/31	14:38:01	20.61	0.13
69	2016/10/31	14:47:01	20.44	0.27
70	2016/10/31	14:48:01	20.52	0.19
71	2016/10/31	14:49:01	20.60	0.13
72	2016/10/31	14:50:01	20.60	0.13
73	2016/10/31	14:59:01	20.29	0.41
74	2016/10/31	15:00:01	20.41	0.29
75	2016/10/31	15:01:01	20.57	0.14
76	2016/10/31	15:02:01	20.60	0.12
77	2016/10/31	15:38:01	20.56	0.19
78	2016/10/31	15:39:01	20.59	0.16
79	2016/10/31	15:40:01	20.63	0.14
80	2016/10/31	15:41:01	20.64	0.14
81	2016/10/31	15:59:01	20.59	0.18
82	2016/10/31	16:00:01	20.60	0.16
83	2016/10/31	16:01:01	20.63	0.15
84	2016/10/31	16:02:01	20.64	0.15
85	2016/10/31	16:38:01	20.50	0.27
86	2016/10/31	16:39:01	20.56	0.20
87	2016/10/31	16:40:01	20.62	0.15
88	2016/10/31	16:41:01	20.63	0.15
89	2016/10/31	16:52:01	20.38	0.37
90	2016/10/31	16:53:01	20.48	0.26
91	2016/10/31	16:54:01	20.60	0.15
92	2016/10/31	16:55:01	20.61	0.15
93	2016/10/31	17:10:01	20.55	0.18
94	2016/10/31	17:11:01	20.58	0.16
95	2016/10/31	17:12:01	20.62	0.15
96	2016/10/31	17:13:01	20.63	0.15
97	2016/10/31	17:36:01	20.35	0.41
98	2016/10/31	17:37:01	20.49	0.27
99	2016/10/31	17:38:01	20.62	0.15

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
100	2016/10/31	17:39:01	20.63	0.15
101	2016/10/31	18:10:01	20.46	0.31
102	2016/10/31	18:11:01	20.51	0.24
103	2016/10/31	18:12:01	20.57	0.16
104	2016/10/31	18:13:01	20.59	0.15
105	2016/10/31	18:23:01	20.32	0.41
106	2016/10/31	18:24:01	20.45	0.27
107	2016/10/31	18:25:01	20.58	0.15
108	2016/10/31	18:26:01	20.59	0.15
109	2016/10/31	18:37:01	20.55	0.17
110	2016/10/31	18:38:01	20.56	0.16
111	2016/10/31	18:39:01	20.58	0.15
112	2016/10/31	18:40:01	20.59	0.15
113	2016/10/31	18:49:01	20.55	0.18
114	2016/10/31	18:50:01	20.57	0.16
115	2016/10/31	18:51:01	20.59	0.15
116	2016/10/31	18:52:01	20.60	0.15
117	2016/10/31	19:02:01	20.36	0.38
118	2016/10/31	19:03:01	20.49	0.25
119	2016/10/31	19:04:01	20.60	0.15
120	2016/10/31	19:05:01	20.61	0.15
Run 3 Average			20.57	0.20

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

Client	ArcelorMittal	**Date**	Oct. 27-28, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 1
Unit	Quench Tower	**Start Time**	21:17
Operation	Normal	**End Time**	5:50
Tester(s)	JV		

Cal.	LOW		MID		HIGH			Conc.	Tank ID			Response Time (sec)	
Gas	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Span**	**Units**	**LOW**	**MID**	**HIGH**	**Up**	**Down**
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	44	45
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	45	44
LIMITS				**40 % to 60 %**		**100%**							

				Initial Values		Final Values							
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	**Actual Upscale Conc.**	**Analyzer Cal. Response**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**Drift (% of Span)**	**Span**	**Average of Initial and Final System Responses**	**Average Indicated Gas Conc.**	**Corrected Gas Conc.**	**Conc. Units**
O2	**Zero**		0.06	0.09	0.15	0.11	0.25	0.10	20.01	0.1			
	Mid	10.21	10.17	10.11	-0.30	10.12	-0.25	0.05	20.01	10.115	20.35	20.64	d. vol. %
CO2	**Zero**		0.05	0.10	0.25	0.09	0.20	-0.05	19.81	0.095			
	Mid	10.08	9.89	9.81	-0.40	9.80	-0.45	-0.05	19.81	9.805	0.15	0.05	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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 28, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 2
Unit	Quench Tower	**Start Time**	6:33
Operation	Normal	**End Time**	14:33
Tester(s)	JV		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
LIMITS				**40 % to 60 %**		**100%**					

				Initial Values		Final Values							
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	**Actual Upscale Conc.**	**Analyzer Cal. Response**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**Drift (% of Span)**	**Span**	**Average of Initial and Final System Responses**	**Average Indicated Gas Conc.**	**Corrected Gas Conc.**	**Conc. Units**
O2	**Zero**		0.06	0.11	0.25	0.13	0.35	0.10	20.01	0.12			
	Mid	10.21	10.17	10.12	-0.25	10.18	0.05	0.30	20.01	10.15	20.58	20.82	d. vol. %
CO2	**Zero**		0.05	0.09	0.20	0.13	0.40	0.20	19.81	0.11			
	Mid	10.08	9.89	9.80	-0.45	9.77	-0.61	-0.15	19.81	9.785	0.14	0.03	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Oct. 31, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	9:37
Operation	Normal	**End Time**	19:15
Tester(s)	JV		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
LIMITS				**40 % to 60 %**		**100%**					

	Upscale: Enter "Low" "Mid" or "High"			Initial Values		Final Values				Average of Initial and Final	Average Indicated	Corrected	
Gas	**below "Zero"**	**Actual Upscale Conc.**	**Analyzer Cal. Response**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**Drift (% of Span)**	**Span**	**System Responses**	**Gas Conc.**	**Gas Conc.**	**Conc. Units**
O2	**Zero**		0.06	0.13	0.35	0.10	0.20	-0.15	20.01	0.115			
	Mid	10.21	10.17	10.18	0.05	10.19	0.10	0.05	20.01	10.185	20.57	20.74	d. vol. %
CO2	**Zero**		0.05	0.13	0.40	0.11	0.30	-0.10	19.81	0.12			
	Mid	10.08	9.89	9.77	-0.61	9.78	-0.56	0.05	19.81	9.775	0.20	0.08	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal	Test Date:	Oct. 27-28, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Quench Tower	Test Start Time:	9:17 PM
Unit Operation:	Normal	Test Finish Time:	5:50 AM

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

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.52	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.408	inches
O2	20.64	% dv
CO2	0.05	% 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)	70.3	F
Stack Temperature (Tsavg)	174.2	F
Orifice Pressure Drop (dHavg)	1.579	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2810	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
Total Test Time	8.55	hours
# of Quenches	24	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.30	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	358.4	g
Water Vapor in Silica Gel (Vwsg(std))	16.899	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	16.899	scf
Volume Dry Gas Metered (Vm)	82.841	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	82.151	dscf
Volume Dry Gas Metered (Vm(m^3))	2.346	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.326	dscm
Stack Absolute Pressure (Ps)	29.52	in. Hg
Stack Absolute Temperature (Tsavg)	633.8	R
H2O Vapor Pressure @ avg Stack Temp.	13.43	in. Hg
H2O in the gas at saturation (Bws)	0.4550	vol. fraction
H2O in the gas from test data (Bws)	0.1706	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1706	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.83	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.99	lb/lb-mole
Gas Velocity (Vs)	18.00	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	972,268	acfm
Standard Gas Flowrate	798,697	scfm
Dry Standard Gas Flowrate	662,433.90	dscfm
Actual Gas Flowrate	27.532	acm/min
Standard Gas Flowrate	22,617	scm/min
Dry Standard Gas Flowrate	18,758	dscm/min
Area Nozzle (An)	0.000908	ft^2
Percent of Isokinetic Sampling (I)	102.5	%

Metals

Mercury			
Emission mass (1B Fraction)	<	0.054	(ug)
Emission mass (2B Fraction)	<	0.260	(ug)
Emission mass (3A Fraction)	<		(ug)
Emission mass (3B Fraction)	<	0.025	(ug)
Emission mass (3C Fraction)		0.062	(ug)
Emission concentration (1B Fraction)	<	2.32E-05	(mg/dscm)
Emission concentration (2B Fraction)	<	1.12E-04	(mg/dscm)
Emission concentration (3A Fraction)	<		(mg/dscm)
Emission concentration (3B Fraction)	<	1.07E-05	(mg/dscm)
Emission concentration (3C Fraction)		2.67E-05	(mg/dscm)
Emission rate (1B Fraction)	<	NA	(lb/hr)
Emission rate (2B Fraction)	<	NA	(lb/hr)
Emission rate (3A Fraction)	<	NA	(lb/hr)
Emission rate (3B Fraction)	<	NA	(lb/hr)
Emission rate (3C Fraction)		NA	(lb/hr)

Chromium			
Front Half Mass Gained		15.200	(ug)
Back Half Mass Gained		131.000	(ug)
Emission Concentration Front-Half		6.53E-03	(mg/dscm)
Emission Concentration Back-Half		5.63E-02	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Cobalt			
Front Half Mass Gained		0.930	(ug)
Back Half Mass Gained		2.170	(ug)
Emission Concentration Front-Half		4.00E-04	(mg/dscm)
Emission Concentration Back-Half		9.33E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Antimony			
Front Half Mass Gained	<	2.000	(ug)
Back Half Mass Gained	<	0.400	(ug)
Emission Concentration Front-Half	<	8.60E-04	(mg/dscm)
Emission Concentration Back-Half	<	1.72E-04	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Lead			
Front Half Mass Gained		10.700	(ug)
Back Half Mass Gained		1.830	(ug)
Emission Concentration Front-Half		4.60E-03	(mg/dscm)
Emission Concentration Back-Half		7.87E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Arsenic			
Front Half Mass Gained		18.600	(ug)
Back Half Mass Gained		0.990	(ug)
Emission Concentration Front-Half		8.00E-03	(mg/dscm)
Emission Concentration Back-Half		4.26E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Manganese			
Front Half Mass Gained		126.000	(ug)
Back Half Mass Gained		106.000	(ug)
Emission Concentration Front-Half		5.42E-02	(mg/dscm)
Emission Concentration Back-Half		4.56E-02	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Beryllium			
Front Half Mass Gained	<	0.500	(ug)
Back Half Mass Gained	<	0.100	(ug)
Emission Concentration Front-Half	<	2.15E-04	(mg/dscm)
Emission Concentration Back-Half	<	4.30E-05	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Nickel			
Front Half Mass Gained		11.600	(ug)
Back Half Mass Gained		67.600	(ug)
Emission Concentration Front-Half		4.99E-03	(mg/dscm)
Emission Concentration Back-Half		2.91E-02	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Cadmium			
Front Half Mass Gained	<	0.500	(ug)
Back Half Mass Gained	<	0.100	(ug)
Emission Concentration Front-Half	<	2.15E-04	(mg/dscm)
Emission Concentration Back-Half	<	4.30E-05	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Selenium			
Front Half Mass Gained	<	5.000	(ug)
Back Half Mass Gained		5.900	(ug)
Emission Concentration Front-Half	<	2.15E-03	(mg/dscm)
Emission Concentration Back-Half		2.54E-03	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

ArcelorMittal Quench Tower — **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	0.080	0.283	1.60	185	64	66
A-1	0.092	0.303	1.84	180	64	67
A-2	0.090	0.300	1.80	179	65	67
A-2	0.081	0.285	1.62	180	65	67
A-3	0.081	0.285	1.62	179	65	67
A-3	0.081	0.285	1.62	183	66	68
B-1	0.074	0.272	1.48	176	71	71
B-1	0.071	0.266	1.42	165	71	72
B-2	0.079	0.281	1.58	167	72	72
B-2	0.090	0.300	1.80	160	72	72
B-3	0.090	0.300	1.80	180	72	72
B-3	0.092	0.303	1.84	169	73	73
C-1	0.070	0.265	1.40	176	73	73
C-1	0.068	0.261	1.36	180	73	73
C-2	0.070	0.265	1.40	162	74	73
C-2	0.085	0.292	1.70	170	73	73
C-3	0.085	0.292	1.70	163	71	73
C-3	0.079	0.281	1.48	160	71	72
D-1	0.070	0.265	1.40	170	70	72
D-1	0.071	0.266	1.42	182	70	71
D-2	0.068	0.261	1.36	188	71	71
D-2	0.085	0.292	1.70	178	71	72
D-3	0.074	0.272	1.48	180	70	71
D-3	0.074	0.272	1.48	168	70	71
Average	0.08	0.281	1.58	174.2		70.3

Initial volume	467.560	ft^3	Initial volume	0.000	liters
Final volume	550.401	ft^3	Final volume	0.000	liters
Total metered	82.841	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	966.4	723.5	242.9			0.0
2	702.2	601.4	100.8			0.0
3	620.2	619.3	0.9			0.0
4	714.5	713.4	1.1			0.0
5	730.3	729.3	1.0			0.0
6	777.6	765.9	11.7			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4511.2	4152.8	358.4	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:	Oct. 27-28, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Quench Tower	Test Start Time:	9:17 PM
Unit Operation:	Normal	Test Finish Time:	5:50 AM

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

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.52	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600	inches
Stack Width (enter 0 if circular stack)	216	inches
Nozzle Diameter (Dn)	0.408	inches
O2	20.64	% dv
CO2	0.05	% 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)	70.3	F
Stack Temperature (Tsavg)	174.2	F
Orifice Pressure Drop (dHavg)	1.579	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2810	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
Total Test Time	8.55	hours
# of Quenches	24	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.30	% dv
Water Collected $(V_f - V_i)$	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected $(W_f - W_i)$	358.4	g
Water Vapor in Silica Gel (Vwsg(std))	16.899	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	16.899	scf
Volume Dry Gas Metered (Vm)	82.841	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	82.151	dscf
Volume Dry Gas Metered $(Vm(m^3))$	2.346	dacm
Vol. Dry Gas Metered Stand.$(Vm(std)m^3)$	2.326	dscm
Stack Absolute Pressure (Ps)	29.52	in. Hg
Stack Absolute Temperature (Tsavg)	633.8	R
H2O Vapor Pressure @ avg Stack Temp.	13.43	in. Hg
H2O in the gas at saturation (Bws)	0.4550	vol. fraction
H2O in the gas from test data (Bws)	0.1706	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1706	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.83	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.99	lb/lb-mole
Gas Velocity (Vs)	18.00	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	972,268	acfm
Standard Gas Flowrate	798,697	scfm
Dry Standard Gas Flowrate	662,434	dscfm
Actual Gas Flowrate	27,532	acm/min
Standard Gas Flowrate	22,617	scm/min
Dry Standard Gas Flowrate	18,758	dscm/min
Area Nozzle (An)	0.000908	ft^2
Percent of Isokinetic Sampling (I)	102.5	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	91	ml
Acetone Wash Weight Gain	136.0	mg
Front Half Filter Particulate	116.0	mg
Total Particulate Mass (m_n)	252.00	mg
Particulate Concentration	0.04733	gr/dscf
Particulate Concentration	108.33	mg/dscm
Particulate Emission Rate	NA	lb/Quench
Particulate Emission Rate	NA	lb/hr

ArcelorMittal Quench Tower **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	0.080	0.283	1.6	185	64	66
A-1	0.092	0.303	1.8	180	64	67
A-2	0.090	0.300	1.8	179	65	67
A-2	0.081	0.285	1.6	180	65	67
A-3	0.081	0.285	1.6	179	65	67
A-3	0.081	0.285	1.6	183	66	68
A-4	0.074	0.272	1.5	176	71	71
A-4	0.071	0.266	1.4	165	71	72
A-5	0.079	0.281	1.6	167	72	72
A-5	0.090	0.300	1.8	160	72	72
A-6	0.090	0.300	1.8	180	72	72
A-6	0.092	0.303	1.8	169	73	73
A-7	0.070	0.265	1.4	176	73	73
A-7	0.068	0.261	1.4	180	73	73
A-8	0.070	0.265	1.4	162	74	73
A-8	0.085	0.292	1.7	170	73	73
A-9	0.085	0.292	1.7	163	71	73
A-9	0.079	0.281	1.5	160	71	72
A-10	0.070	0.265	1.4	170	70	72
A-10	0.071	0.266	1.4	182	70	71
A-11	0.068	0.261	1.4	188	71	71
A-11	0.085	0.292	1.7	178	71	72
A-12	0.074	0.272	1.5	180	70	71
A-12	0.074	0.272	1.5	168	70	71
Average	0.08	0.281	1.58	174.2		70.3

Initial volume	467.560	ft^3	Initial volume	0.000	liters
Final volume	550.401	ft^3	Final volume	0.000	liters
Total metered	82.841	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	966.4	723.5	242.9	0.0	0.0	0.0
2	702.2	601.4	100.8	0.0	0.0	0.0
3	620.2	619.3	0.9	0.0	0.0	0.0
4	714.5	713.4	1.1	0.0	0.0	0.0
5	730.3	729.3	1.0	0.0	0.0	0.0
6	777.6	765.9	11.7	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	4511.2	4152.8	358.4	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 28, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Quench Tower	Test Start Time:	6:33 AM
Unit Operation:	Normal	Test Finish Time:	2:33 PM

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

Data Input

Control Box:	1774	
Meter DH@ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.34	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.408	inches
O2	20.82	% dv
CO2	0.03	% 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)	75.9	F
Stack Temperature (Tsavg)	177.4	F
Orifice Pressure Drop (dHavg)	1.508	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2746	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

Total Test Time	8.00	hours
# of Quenches	24	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.14	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	372.1	g
Water Vapor in Silica Gel (Vwsg(std))	17.545	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	17.545	scf
Volume Dry Gas Metered (Vm)	81.732	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	79.712	dscf
Volume Dry Gas Metered (Vm(m^3))	2.314	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.257	dscm
Stack Absolute Pressure (Ps)	29.34	in. Hg
Stack Absolute Temperature (Tsavg)	637.1	R
H2O Vapor Pressure @ avg Stack Temp.	14.45	in. Hg
H2O in the gas at saturation (Bws)	0.4926	vol. fraction
H2O in the gas from test data (Bws)	0.1804	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1804	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.88	lb/lb-mole
Gas Velocity (Vs)	17.73	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	957,215	acfm
Standard Gas Flowrate	777,552	scfm
Dry Standard Gas Flowrate	637,286	dscfm
Actual Gas Flowrate	27,105	acm/min
Standard Gas Flowrate	22,018	scm/min
Dry Standard Gas Flowrate	18,046	dscm/min
Area Nozzle (An)	0.000908	ft^2
Percent of Isokinetic Sampling (I)	103.38	%

Metals

Mercury			
Emission mass (1B Fraction)	<	0.030	(ug)
Emission mass (2B Fraction)	<	0.360	(ug)
Emission mass (3A Fraction)	<		(ug)
Emission mass (3B Fraction)	<	0.023	(ug)
Emission mass (3C Fraction)		0.050	(ug)
Emission concentration (1B Fraction)	<	1.33E-05	(mg/dscm)
Emission concentration (2B Fraction)	<	1.59E-04	(mg/dscm)
Emission concentration (3A Fraction)	<	0.00E+00	(mg/dscm)
Emission concentration (3B Fraction)	<	1.02E-05	(mg/dscm)
Emission concentration (3C Fraction)		2.22E-05	(mg/dscm)
Emission rate (1B Fraction)	<	NA	(lb/hr)
Emission rate (2B Fraction)	<	NA	(lb/hr)
Emission rate (3A Fraction)	<		(lb/hr)
Emission rate (3B Fraction)	<	NA	(lb/hr)
Emission rate (3C Fraction)		NA	(lb/hr)

Antimony			
Front Half Mass Gained	<	2.000	(ug)
Back Half Mass Gained	<	0.400	(ug)
Emission Concentration Front-Half	<	8.86E-04	(mg/dscm)
Emission Concentration Back-Half	<	1.77E-04	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Arsenic			
Front Half Mass Gained		26.600	(ug)
Back Half Mass Gained		9.290	(ug)
Emission Concentration Front-Half		1.18E-02	(mg/dscm)
Emission Concentration Back-Half		4.12E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Beryllium			
Front Half Mass Gained	<	0.500	(ug)
Back Half Mass Gained	<	0.100	(ug)
Emission Concentration Front-Half	<	2.22E-04	(mg/dscm)
Emission Concentration Back-Half	<	4.43E-05	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Cadmium			
Front Half Mass Gained	<	0.500	(ug)
Back Half Mass Gained	<	0.100	(ug)
Emission Concentration Front-Half	<	2.22E-04	(mg/dscm)
Emission Concentration Back-Half	<	4.43E-05	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Chromium			
Front Half Mass Gained		3.400	(ug)
Back Half Mass Gained		2.510	(ug)
Emission Concentration Front-Half		1.51E-03	(mg/dscm)
Emission Concentration Back-Half		1.11E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Cobalt			
Front Half Mass Gained		0.530	(ug)
Back Half Mass Gained		0.300	(ug)
Emission Concentration Front-Half		2.35E-04	(mg/dscm)
Emission Concentration Back-Half		1.33E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Lead			
Front Half Mass Gained		8.600	(ug)
Back Half Mass Gained		0.770	(ug)
Emission Concentration Front-Half		3.81E-03	(mg/dscm)
Emission Concentration Back-Half		3.41E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Manganese			
Front Half Mass Gained		6.700	(ug)
Back Half Mass Gained		13.200	(ug)
Emission Concentration Front-Half		2.97E-03	(mg/dscm)
Emission Concentration Back-Half		5.85E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Nickel			
Front Half Mass Gained		4.100	(ug)
Back Half Mass Gained		2.560	(ug)
Emission Concentration Front-Half		1.82E-03	(mg/dscm)
Emission Concentration Back-Half		1.13E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Selenium			
Front Half Mass Gained	<	5.000	(ug)
Back Half Mass Gained		3.500	(ug)
Emission Concentration Front-Half	<	2.22E-03	(mg/dscm)
Emission Concentration Back-Half		1.55E-03	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

ArcelorMittal Run 2 F or C?
Quench Tower 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	0.072	0.268	1.4	181	71	71
A-1	0.072	0.268	1.4	180	70	70
A-2	0.080	0.283	1.6	172	70	70
A-2	0.078	0.279	1.6	176	71	70
A-3	0.070	0.265	1.4	182	72	71
A-3	0.078	0.279	1.6	176	74	72
B-1	0.080	0.283	1.6	179	75	73
B-1	0.071	0.266	1.4	184	76	74
B-2	0.070	0.265	1.4	173	77	75
B-2	0.079	0.281	1.6	185	79	76
B-3	0.081	0.285	1.6	176	79	77
B-3	0.082	0.286	1.6	181	77	76
C-1	0.070	0.265	1.4	174	77	76
C-1	0.076	0.276	1.5	171	77	76
C-2	0.072	0.268	1.4	177	78	75
C-2	0.080	0.283	1.6	172	77	75
C-3	0.075	0.274	1.5	180	77	75
C-3	0.079	0.281	1.6	175	78	76
D-1	0.073	0.270	1.5	174	80	77
D-1	0.069	0.263	1.4	183	80	78
D-2	0.081	0.285	1.6	177	82	78
D-2	0.077	0.277	1.5	173	81	79
D-3	0.070	0.265	1.4	182	83	80
D-3	0.076	0.276	1.5	175	81	80
Average	0.08	0.275	1.51	177.4		75.9

Initial volume	551.546	ft^3	Initial volume	0.000	liters
Final volume	633.278	ft^3	Final volume	0.000	liters
Total metered	81.732	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	955.4	709.7	245.7			0.0
2	821.1	711.4	109.7			0.0
3	601.1	600.5	0.6			0.0
4	728.4	727.9	0.5			0.0
5	710.9	710.4	0.5			0.0
6	789.9	774.8	15.1			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4606.8	4234.7	372.1	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal	Test Date:	October 28, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Quench Tower	Test Start Time:	6:33 AM
Unit Operation:	Normal	Test Finish Time:	2:33 PM

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

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.34	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.408	inches
O2	20.82	% dv
CO2	0.03	% 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)	75.9	F
Stack Temperature (Tsavg)	177.4	F
Orifice Pressure Drop (dHavg)	1.508	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2746	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
Total Test Time	8.00	hours
# of Quenches	24	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	85	ml
Acetone Wash Weight Gain	18.3	mg
Front Half Filter Particulate	22.6	mg
Total Particulate Mass (m_n)	40.90	mg
Particulate Concentration	0.00792	gr/dscf
Particulate Concentration	18.12	mg/dscm
Particulate Emission Rate	NA	lb/Quench
Particulate Emission Rate	NA	lb/hr

Calculations

CO + N2	79.14	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	372.1	g
Water Vapor in Silica Gel (Vwsg(std))	17.545	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	17.545	scf
Volume Dry Gas Metered (Vm)	81.732	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	79.712	dscf
Volume Dry Gas Metered (Vm(m^3))	2.314	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.257	dscm
Stack Absolute Pressure (Ps)	29.34	in. Hg
Stack Absolute Temperature (Tsavg)	637.1	R
H2O Vapor Pressure @ avg Stack Temp.	14.45	in. Hg
H2O in the gas at saturation (Bws)	0.4926	vol. fraction
H2O in the gas from test data (Bws)	0.1804	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1804	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.88	lb/lb-mole
Gas Velocity (Vs)	17.73	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	957.215	acfm
Standard Gas Flowrate	777.552	scfm
Dry Standard Gas Flowrate	637.286	dscfm
Actual Gas Flowrate	27.105	acm/min
Standard Gas Flowrate	22.018	scm/min
Dry Standard Gas Flowrate	18.046	dscm/min
Area Nozzle (An)	0.000908	ft^2
Percent of Isokinetic Sampling (I)	103.4	%

ArcelorMittal **Run 2** **F or C?**
Top of Quench Tower **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	0.072	0.268	1.4	181	71	71
A-1	0.072	0.268	1.4	180	70	70
A-2	0.080	0.283	1.6	172	70	70
A-2	0.078	0.279	1.6	176	71	70
A-3	0.070	0.265	1.4	182	72	71
A-3	0.078	0.279	1.6	176	74	72
A-4	0.080	0.283	1.6	179	75	73
A-4	0.071	0.266	1.4	184	76	74
A-5	0.070	0.265	1.4	173	77	75
A-5	0.079	0.281	1.6	185	79	76
A-6	0.081	0.285	1.6	176	79	77
A-6	0.082	0.286	1.6	181	77	76
A-7	0.070	0.265	1.4	174	77	76
A-7	0.076	0.276	1.5	171	77	76
A-8	0.072	0.268	1.4	177	78	75
A-8	0.080	0.283	1.6	172	77	75
A-9	0.075	0.274	1.5	180	77	75
A-9	0.079	0.281	1.6	175	78	76
A-10	0.073	0.270	1.5	174	80	77
A-10	0.069	0.263	1.4	183	80	78
A-11	0.081	0.285	1.6	177	82	78
A-11	0.077	0.277	1.5	173	81	79
A-12	0.070	0.265	1.4	182	83	80
A-12	0.076	0.276	1.5	175	81	80
Average	0.08	0.275	1.51	177.4		75.9

Initial volume	551.546	ft^3	Initial volume	0.000	liters
Final volume	633.278	ft^3	Final volume	0.000	liters
Total metered	81.732	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	955.4	709.7	245.7	0.0	0.0	0.0
2	821.1	711.4	109.7	0.0	0.0	0.0
3	601.1	600.5	0.6	0.0	0.0	0.0
4	728.4	727.9	0.5	0.0	0.0	0.0
5	710.9	710.4	0.5	0.0	0.0	0.0
6	789.9	774.8	15.1	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	4606.8	4234.7	372.1	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal	Test Date:	Oct. 31, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Quench Tower	Test Start Time:	9:37 AM
Unit Operation:	Normal	Test Finish Time:	7:15 PM

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

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.42	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.408	inches
O2	20.74	% dv
CO2	0.08	% 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)	69.9	F
Stack Temperature (Tsavg)	177.5	F
Orifice Pressure Drop (dHavg)	1.446	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2755	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
Total Test Time	9.63	hours
# of Quenches	24	Quenches/test
Avg. # of Quenches per hour	2.49	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.18	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	388.6	g
Water Vapor in Silica Gel (Vwsg(std))	18.322	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	18.322	scf
Volume Dry Gas Metered (Vm)	79.267	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	78.387	dscf
Volume Dry Gas Metered (Vm(m^3))	2.245	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.220	dscm
Stack Absolute Pressure (Ps)	29.42	in. Hg
Stack Absolute Temperature (Tsavg)	637.2	R
H2O Vapor Pressure @ avg Stack Temp.	14.49	in. Hg
H2O in the gas at saturation (Bws)	0.4926	vol. fraction
H2O in the gas from test data (Bws)	0.1895	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1895	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.79	lb/lb-mole
Gas Velocity (Vs)	17.80	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	961,005	acfm
Standard Gas Flowrate	782,606	scfm
Dry Standard Gas Flowrate	634,333	dscfm
Actual Gas Flowrate	27,213	acm/min
Standard Gas Flowrate	22,161	scm/min
Dry Standard Gas Flowrate	17,962	dscm/min
Area Nozzle (An)	0.000908	ft^2
Percent of Isokinetic Sampling (I)	102.14	%

Metals

Mercury			
Emission mass (1B Fraction)	<	0.030	(ug)
Emission mass (2B Fraction)	<	0.350	(ug)
Emission mass (3A Fraction)	<		(ug)
Emission mass (3B Fraction)	<	0.023	(ug)
Emission mass (3C Fraction)		0.043	(ug)
Emission concentration (1B Fraction)	<	1.35E-05	(mg/dscm)
Emission concentration (2B Fraction)	<	1.58E-04	(mg/dscm)
Emission concentration (3A Fraction)	<	0.00E+00	(mg/dscm)
Emission concentration (3B Fraction)	<	1.04E-05	(mg/dscm)
Emission concentration (3C Fraction)		1.94E-05	(mg/dscm)
Emission rate (1B Fraction)	<	NA	(lb/hr)
Emission rate (2B Fraction)	<	NA	(lb/hr)
Emission rate (3A Fraction)	<		(lb/hr)
Emission rate (3B Fraction)	<	NA	(lb/hr)
Emission rate (3C Fraction)		NA	(lb/hr)

Antimony			
Front Half Mass Gained		2.100	(ug)
Back Half Mass Gained	<	0.400	(ug)
Emission Concentration Front-Half		9.46E-04	(mg/dscm)
Emission Concentration Back-Half	<	1.80E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Arsenic			
Front Half Mass Gained		27.000	(ug)
Back Half Mass Gained		4.270	(ug)
Emission Concentration Front-Half		1.22E-02	(mg/dscm)
Emission Concentration Back-Half		1.92E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Beryllium			
Front Half Mass Gained	<	0.500	(ug)
Back Half Mass Gained	<	0.100	(ug)
Emission Concentration Front-Half	<	2.25E-04	(mg/dscm)
Emission Concentration Back-Half	<	4.51E-05	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Cadmium			
Front Half Mass Gained	<	0.500	(ug)
Back Half Mass Gained	<	0.100	(ug)
Emission Concentration Front-Half	<	2.25E-04	(mg/dscm)
Emission Concentration Back-Half	<	4.51E-05	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half	<	NA	(lb/hr)

Chromium			
Front Half Mass Gained		39.000	(ug)
Back Half Mass Gained		6.440	(ug)
Emission Concentration Front-Half		1.76E-02	(mg/dscm)
Emission Concentration Back-Half		2.90E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Cobalt			
Front Half Mass Gained		1.460	(ug)
Back Half Mass Gained		0.210	(ug)
Emission Concentration Front-Half		6.58E-04	(mg/dscm)
Emission Concentration Back-Half		9.46E-05	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Lead			
Front Half Mass Gained		8.900	(ug)
Back Half Mass Gained		0.840	(ug)
Emission Concentration Front-Half		4.01E-03	(mg/dscm)
Emission Concentration Back-Half		3.78E-04	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Manganese			
Front Half Mass Gained		47.500	(ug)
Back Half Mass Gained		132.000	(ug)
Emission Concentration Front-Half		2.14E-02	(mg/dscm)
Emission Concentration Back-Half		5.95E-02	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Nickel			
Front Half Mass Gained		32.200	(ug)
Back Half Mass Gained		12.100	(ug)
Emission Concentration Front-Half		1.45E-02	(mg/dscm)
Emission Concentration Back-Half		5.45E-03	(mg/dscm)
Emission Rate Front-Half		NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

Selenium			
Front Half Mass Gained	<	5.000	(ug)
Back Half Mass Gained		3.100	(ug)
Emission Concentration Front-Half	<	2.25E-03	(mg/dscm)
Emission Concentration Back-Half		1.40E-03	(mg/dscm)
Emission Rate Front-Half	<	NA	(lb/hr)
Emission Rate Back-Half		NA	(lb/hr)

ArcelorMittal Quench Tower — **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	0.074	0.272	1.4	182	64	63
A-1	0.079	0.281	1.5	179	65	63
A-2	0.073	0.270	1.4	174	66	64
A-2	0.076	0.276	1.4	175	66	66
A-3	0.081	0.285	1.5	184	68	67
A-3	0.077	0.277	1.5	179	68	67
B-1	0.075	0.274	1.4	180	69	67
B-1	0.080	0.283	1.5	173	70	68
B-2	0.076	0.276	1.4	179	70	69
B-2	0.079	0.281	1.5	182	71	70
B-3	0.083	0.288	1.6	177	73	72
B-3	0.075	0.274	1.4	171	74	72
C-1	0.071	0.266	1.4	179	75	74
C-1	0.076	0.276	1.5	185	76	75
C-2	0.081	0.285	1.5	176	77	75
C-2	0.074	0.272	1.4	170	78	77
C-3	0.077	0.277	1.5	178	72	75
C-3	0.072	0.268	1.4	172	69	70
D-1	0.076	0.276	1.5	175	68	68
D-1	0.069	0.263	1.3	184	69	68
D-2	0.075	0.274	1.4	178	69	68
D-2	0.073	0.270	1.4	181	69	68
D-3	0.077	0.277	1.5	173	70	69
D-3	0.074	0.272	1.4	175	72	70
Average	0.08	0.276	1.45	177.5		69.9

Initial volume	635.500	ft^3	Initial volume	0.000	liters
Final volume	714.767	ft^3	Final volume	0.000	liters
Total metered	79.267	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	989.8	732.9	256.9			0.0
2	848.7	733.5	115.2			0.0
3	619.7	617.8	1.9			0.0
4	723.9	723.3	0.6			0.0
5	737.6	738.1	-0.5			0.0
6	794.3	779.8	14.5			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4714.0	4325.4	388.6	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal	Test Date:	Oct. 31, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Quench Tower	Test Start Time:	9:37 AM
Unit Operation:	Normal	Test Finish Time:	7:15 PM

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

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.42	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.408	inches
O2	20.74	% dv
CO2	0.08	% 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)	69.9	F
Stack Temperature (Tsavg)	177.5	F
Orifice Pressure Drop (dHavg)	1.446	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2755	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
Total Test Time	9.63	hours
# of Quenches	24	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.18	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	388.6	g
Water Vapor in Silica Gel (Vwsg(std))	18.322	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	18.322	scf
Volume Dry Gas Metered (Vm)	79.267	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	78.387	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	2.245	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	2.220	dscm
Stack Absolute Pressure (Ps)	29.42	in. Hg
Stack Absolute Temperature (Tsavg)	637.2	R
H2O Vapor Pressure @ avg Stack Temp.	14.49	in. Hg
H2O in the gas at saturation (Bws)	0.4926	vol. fraction
H2O in the gas from test data (Bws)	0.1895	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1895	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.79	lb/lb-mole
Gas Velocity (Vs)	17.80	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	961,005	acfm
Standard Gas Flowrate	782,606	scfm
Dry Standard Gas Flowrate	634,333	dscfm
Actual Gas Flowrate	27,213	acm/min
Standard Gas Flowrate	22,161	scm/min
Dry Standard Gas Flowrate	17,962	dscm/min
Area Nozzle (An)	0.000908	ft^2
Percent of Isokinetic Sampling (I)	102.1	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	110	ml
Acetone Wash Weight Gain	309.0	mg
Front Half Filter Particulate	205.0	mg
Total Particulate Mass (m_n)	514.00	mg
Particulate Concentration	0.1012	gr/dscf
Particulate Concentration	231.57	mg/dscm
Particulate Emission Rate	NA	lb/Quench
Particulate Emission Rate	NA	lb/hr

ArcelorMittal Quench Tower **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	0.074	0.272	1.4	182	64	63
A-1	0.079	0.281	1.5	179	65	63
A-2	0.073	0.270	1.4	174	66	64
A-2	0.076	0.276	1.4	175	66	66
A-3	0.081	0.285	1.5	184	68	67
A-3	0.077	0.277	1.5	179	68	67
A-4	0.075	0.274	1.4	180	69	67
A-4	0.080	0.283	1.5	173	70	68
A-5	0.076	0.276	1.4	179	70	69
A-5	0.079	0.281	1.5	182	71	70
A-6	0.083	0.288	1.6	177	73	72
A-6	0.075	0.274	1.4	171	74	72
A-7	0.071	0.266	1.4	179	75	74
A-7	0.076	0.276	1.5	185	76	75
A-8	0.081	0.285	1.5	176	77	75
A-8	0.074	0.272	1.4	170	78	77
A-9	0.077	0.277	1.5	178	72	75
A-9	0.072	0.268	1.4	172	69	70
A-10	0.076	0.276	1.5	175	68	68
A-10	0.069	0.263	1.3	184	69	68
A-11	0.075	0.274	1.4	178	69	68
A-11	0.073	0.270	1.4	181	69	68
A-12	0.077	0.277	1.5	173	70	69
A-12	0.074	0.272	1.4	175	72	70
Average	0.08	0.276	1.45	177.5		69.9

Initial volume	635.500	ft^3	Initial volume	0.000	liters
Final volume	714.767	ft^3	Final volume	0.000	liters
Total metered	79.267	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	989.8	732.9	256.9			0.0
2	848.7	733.5	115.2			0.0
3	619.7	617.8	1.9			0.0
4	723.9	723.3	0.6			0.0
5	737.6	738.1	-0.5			0.0
6	794.3	779.8	14.5			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4714.0	4325.4	388.6	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.978	**Start Time:**	21:17
Date:	10/27/16 - 10/28/16	**Run Number:**	1	**Meter Correction (γ):**	1.006	**Stop Time:**	5:50
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	.408	**Pitot Correction:**	0.84	**T/C ID:**	9-2
Sampling Location:	Quench Stack Outlet	**Static Press (in. H_2O):**	+.01	**Control Box ID:**	1774	**Probe ID:**	9-2
		Baro. Pres. (in. Hg):	29.52	**Assumed Moisture (%):**	20	**Pitot ID:**	9-2
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	37	**Umbilical Length (Feet):**	200'	**Filter ID:**	
Test Crew:	JV JW TL TM CB	**Initial K-factor**	1.00			**Stack Diameter (inches):**	600 x 216 Rect

(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	467.560										
A-1	0:05:00	470.702	0.080	1.60	5	185	247	249	55	64	66	
A-1	0:10:00	473.295	0.092	1.84	5	180	248	249	52	64	67	
A-2	0:15:00	476.928	0.090	1.80	5	179	249	250	52	65	67	
A-2	0:20:00	480.212	0.081	1.62	5	180	250	250	50	65	67	
A-3	0:25:00	483.265	0.081	1.62	5	179	249	255	50	65	67	
A-3	0:30:00	487.032	0.081	1.62	5	183	240	257	52	66	68	
B-1	0:35:00	490.284	0.074	1.48	5	176	243	254	49	71	71	
B-1	0:40:00	493.696	0.071	1.42	5	165	249	254	54	71	72	
B-2	0:45:00	497.106	0.079	1.58	5	167	249	254	53	72	72	
B-2	0:50:00	501.011	0.090	1.80	5	160	248	256	51	72	72	
B-3	0:55:00	504.818	0.090	1.80	5	180	250	254	50	72	72	
B-3	1:00:00	508.376	0.092	1.84	5	169	240	252	47	73	73	
C-1	1:05:00	512.100	0.070	1.40	5	176	270	252	52	73	73	
C-1	1:10:00	515.631	0.068	1.36	5	180	255	250	50	73	73	
C-2	1:15:00	516.827	0.070	1.40	5	162	240	260	49	74	73	
C-2	1:20:00	522.178	0.085	1.70	5	170	263	242	50	73	73	
C-3	1:25:00	526.232	0.085	1.70	5	163	240	245	50	71	73	
C-3	1:30:00	529.640	0.074	1.48	5	160	270	240	50	71	72	
D-1	1:35:00	533.216	0.070	1.40	5	170	255	255	50	70	72	
D-1	1:40:00	535.963	0.071	1.42	5	182	255	250	52	70	71	
D-2	1:45:00	540.221	0.068	1.36	5	188	250	251	50	71	71	
D-2	1:50:00	543.81	0.085	1.70	5	178	250	253	49	71	72	
D-3	1:55:00	547.002	0.074	1.48	5	180	265	254	48	70	71	
D-3	2:00:00	550.401	0.074	1.48	5	168	260	253	49	70	71	

(max leak rate = 0.02 ft³/min)

Sample Train Leak Check		(in. Hg)	(ft³/min)
	Initial	12	0.000
	Final	8	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)	466.4	723.5	
2	5%HNO_3/10%H_2O_2 (g)	702.2	601.4	
3	Empty (g)	620.2	619.3	
4	10%H_2SO_4/$KMnO_4$ (g)	719.5	713.4	
5	10%H_2SO_4/$KMnO_4$ (g)	730.3	729.3	
6	Silica (g)	727.6	965.9	

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.977	**Start Time:**	06:33
Date:	10/28/16 - 10/28/16	**Run Number:**	2	**Meter Correction (γ):**	1.006	**Stop Time:**	14:33
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.408	**Pitot Correction:**	0.84	**T/C ID:**	9-2
Sampling Location:	Quench Tower. Outlet	**Static Press (in. H_2O):**	.01	**Control Box ID:**	MB 1774	**Probe ID:**	9-2
		Baro. Pres. (in. Hg):	29.34	**Assumed Moisture (%):**	20%	**Pitot ID:**	9-2
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	50	**Umbilical Length (Feet):**	200'	**Filter ID:**	06992
Test Crew:	JV JW TL TM CB	**Initial K-factor**	20.0			**Stack Diameter (inches):**	

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time 0:00:00	Metered Volume (ft³) 551.546	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-1	0:05:00	555.011	0.072	1.44	5	181	262	255	43	71	71	
A-1	0:10:00	558.463	0.072	1.44	5	180	248	255	42	70	70	
A-2	0:15:00	561.78	0.080	1.60	5	172	252	254	42	70	70	
A-2	0:20:00	565.340	.078	1.6	5	176	241	254	43	71	70	
A-3	0:25:00	568.67	.070	1.4	5	182	232	254	46	72	71	
A-3	0:30:00	572.09	.078	1.6	5	176	244	252	45	74	72	
B-1	0:35:00	575.44	.080	1.6	5	179	256	255	47	75	73	
B-1	0:40:00	578.153	.071	1.4	5	184	256	251	49	76	74	
B-2	0:45:00	581.76	.070	1.4	5	173	246	254	50	77	75	
B-2	0:50:00	585.46	.079	1.6	5	185	252	255	51	79	76	
B-3	0:55:00	589.09	.081	1.6	5	176	256	254	52	79	77	
B-3	1:00:00	592.632	.082	1.6	5	181	241	253	51	77	76	
C-1	1:05:00	595.13	.070	1.4	5	174	239	252	53	77	76	
C-1	1:10:00	599.31	.076	1.5	5	171	235	249	60	77	76	
C-2	1:15:00	602.60	.072	1.4	5	177	244	255	57	78	75	
C-2	1:20:00	606.024	.080	1.6	5	172	240	255	47	77	75	
C-3	1:25:00	609.37	.075	1.5	5	180	244	251	46	77	75	
C-3	1:30:00	612.91	.079	1.6	5	175	254	255	48	78	76	
D-1	1:35:00	616.39	.073	1.5	5	174	240	254	46	80	77	
D-1	1:40:00	619.802	.069	1.4	5	183	248	255	47	80	78	
D-2	1:45:00	623.13	.081	1.6	5	177	239	254	48	82	78	
D-2	1:50:00	626.58	.077	1.5	5	173	249	255	52	81	79	
D-3	1:55:00	629.84	.070	1.4	5	182	237	255	51	83	80	
D-3	2:00:00	633.278	.076	1.5	5	175	250	249	54	81	80	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	12	0.000
Check	Final	9	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:	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)	985.4	709.7	
2	5%HNO_3/10%H_2O_2 (g)	821.1	711.4	
3	Empty (g)	601.1	600.5	
4	10%H_2SO_4/$KMnO_4$ (g)	728.4	727.9	
5	10%H_2SO_4/$KMnO_4$ (g)	710.9	710.4	
6	Silica (g)	789.9	774.8	

MONTROSE METHOD 5/29 DATA SHEET

Page 1 of 1

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.977	**Start Time:**	09:37
Date:	10-31-16	**Run Number:**	3	**Meter Correction (γ):**	1.006	**Stop Time:**	07:15
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.408	**Pitot Correction:**	0.84	**T/C ID:**	9-2
Sampling Location:	Quench Stack Outlet	**Static Press (in. H_2O):**	0.01	**Control Box ID:**	MB 1774	**Probe ID:**	9-2
		Baro. Pres. (in. Hg):	29.42	**Assumed Moisture (%):**	20	**Pitot ID:**	9-2
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	42	**Umbilical Length (Feet):**	200'	**Filter ID:**	07068
Test Crew:	JV JW TL TM CB	**Initial K-factor**	18.9 *19.1			**Stack Diameter (inches):**	600 x 216 RECT

(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	635.500										
A-1	0:05:00	638.66	.074	1.4	5	182	259	254	39	64	63	
A-1	0:10:00	641.94	.079	1.5	5	179	259	254	38	65	63	
A-2	0:15:00	645.21	.073	1.4	5	174	259	252	40	66	69	
A-2	0:20:00	648.512	.076	1.4	5	175	260	252	44	66	66	
A-3	0:25:00	651.89	.081	1.5	5	184	258	254	44	68	67	
A-3	0:30:00	655.17	.077	1.5	5	179	259	255	44	68	67	
B-1	0:35:00	658.51	.075	1.4	5	180	259	255	44	69	67	
B-1	0:40:00	661.862	.080	1.5	5	173	259	251	44	70	68	
B-2	0:45:00	665.12	.076	1.4	5	179	259	253	44	70	69	
B-2	0:50:00	668.47	.079	1.5	5	182	258	255	45	71	70	*19.1
B-3	0:55:00	671.94	.083	1.6	5	177	259	250	46	73	72	
B-3	1:00:00	675.278	.075	1.4	5	171	259	256	45	74	72	
C-1	1:05:00	678.59	.071	1.4	5	179	259	253	49	75	74	
C-1	1:10:00	681.99	.076	1.5	5	185	258	251	48	76	75	
C-2	1:15:00	685.24	.081	1.5	5	176	258	256	50	77	75	
C-2	1:20:00	688.607	.074	1.4	5	170	259	255	52	78	77	
C-3	1:25:00	691.91	.077	1.5	5	178	259	251	50	72	73	
C-3	1:30:00	695.15	.072	1.4	5	172	259	252	49	69	~~75~~ 70	RCO 10-31-16
D-1	1:35:00	698.58	.076	1.5	5	175	259	254	47	68	68	
D-1	1:40:00	701.662	.069	1.3	5	184	259	253	49	69	68	
D-2	1:45:00	704.95	.075	1.4	5	178	259	249	49	69	68	
D-2	1:50:00	708.13	.073	1.4	5	181	259	254	49	69	68	
D-3	1:55:00	711.49	.077	1.5	5	173	258	254	48	70	69	
D-3	2:00:00	714.767	.074	1.4	5	175	259	253	50	72	70	

(max leak rate = 0.02 ft³/min)

Sample Train Leak Check		(in. Hg)	(ft³/min)
	Initial	15	0.006
	Final	8	0.002
		Pressure (+)	Static (-)
Pitot Leak Check	Initial	✓	✓
	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

* changed K-Factor @ B-2

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)	989.8	732.9	
2	5%HNO_3/10%H_2O_2 (g)	848.7	733.5	
3	Empty (g)	619.7	617.8	
4	10%H_2SO_4/$KMnO_4$ (g)	723.9	723.3	
5	10%H_2SO_4/$KMnO_4$ (g)	737.6	738.1	
6	Silica (g)	794.3	779.8	

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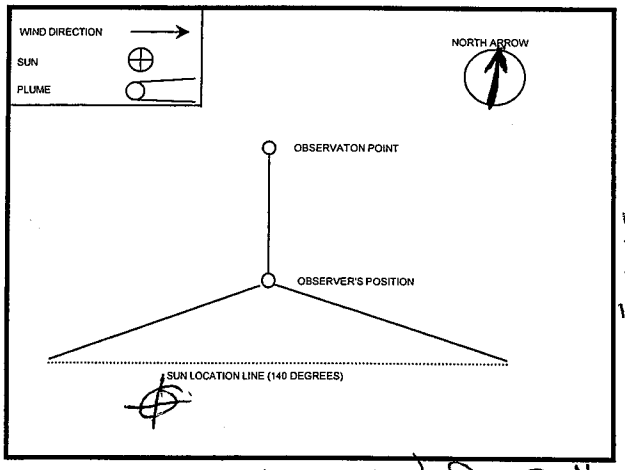
VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167
COMPANY NAME	ArcelorMittal Monessen
SOURCE	Quench Tower
LOCATION	sitting by Rail stops on plant
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Coke oven Battery
OPERATING MODE	Normal
CONTROL EQUIPMENT	Quench Baffels
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL	START 100 END 100
HEIGHT RELATIVE TO OBSERVER	START 100 END 100
DISTANCE FROM OBSERVER	START 1800 END 1800
DIRECTION FROM OBSERVER	START N END N
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START S END S
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈ 1800 END ≈ 1800
DESCRIBE EMISSIONS	START
DECRIBE EMISSIONS	END
EMISSION COLOR	START END
IF WATER DROPLET PLUME	ATTACHED ATTACHED N/A
DESCRIBE PLUME BACKGROUND	START Trees END Trees
SKY CONDITIONS	START Partly Cloudy END
WIND SPEED	START 0-5 END
WIND DIRECTION	START NE END
AMBIENT TEMP	START 45 END
WET BULB TEMP	START 38 END
PERCENT HUMIDITY	START 76 END



START TIME ~~9:49~~ 11:29 STOP TIME ~~10:49~~

	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

9:49 Q
10:08 Q
10:11 Q 10:51
10:59
Q 11:04
11:09
Q 11:15
11:19

@ 10:11 paused for Battery Break
Quench @ 10:51 restart reading

MONTROSE ENVIRONMENTAL

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	DATE 10-31-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

Method 0010/23

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/27	03:30:01	21.04	0.01
2	2016/10/27	03:31:01	21.04	0.03
3	2016/10/27	03:32:01	20.82	0.03
4	2016/10/27	03:33:01	21.01	0.01
5	2016/10/27	03:43:01	21.05	0.02
6	2016/10/27	03:44:01	20.68	0.00
7	2016/10/27	03:45:01	21.05	0.03
8	2016/10/27	03:46:01	21.05	0.03
9	2016/10/27	04:14:01	21.07	0.02
10	2016/10/27	04:15:01	20.79	0.04
11	2016/10/27	04:16:01	21.05	0.01
12	2016/10/27	04:17:01	21.06	0.01
13	2016/10/27	04:26:01	21.06	0.03
14	2016/10/27	04:27:01	20.73	0.02
15	2016/10/27	04:28:01	21.06	0.01
16	2016/10/27	04:29:01	21.07	0.03
17	2016/10/27	04:39:01	21.08	0.01
18	2016/10/27	04:40:01	20.83	0.04
19	2016/10/27	04:41:01	21.06	0.03
20	2016/10/27	04:42:01	21.08	0.00
21	2016/10/27	04:52:01	21.08	0.02
22	2016/10/27	04:53:01	20.83	0.00
23	2016/10/27	04:54:01	21.05	0.03
24	2016/10/27	04:55:01	21.08	0.03
25	2016/10/27	05:05:01	21.07	0.02
26	2016/10/27	05:06:01	20.97	0.04
27	2016/10/27	05:07:01	20.98	0.02
28	2016/10/27	05:08:01	21.07	0.01
29	2016/10/27	05:24:01	21.06	0.04
30	2016/10/27	05:25:01	20.93	0.02
31	2016/10/27	05:26:01	21.06	0.01
32	2016/10/27	05:27:01	21.06	0.03
33	2016/10/27	05:57:01	21.07	0.03
34	2016/10/27	05:58:01	20.94	0.01
35	2016/10/27	05:59:01	21.07	0.01
36	2016/10/27	06:00:01	21.07	0.03
37	2016/10/27	06:09:01	21.06	0.01
38	2016/10/27	06:10:01	20.98	0.03
39	2016/10/27	06:11:01	21.07	0.03
40	2016/10/27	06:12:01	21.08	0.02
41	2016/10/27	06:24:01	21.06	0.00
42	2016/10/27	06:25:01	20.91	0.03
43	2016/10/27	06:26:01	21.06	0.03
44	2016/10/27	06:27:01	21.07	0.01
45	2016/10/27	07:15:01	19.71	0.00
46	2016/10/27	07:16:01	19.55	0.02
47	2016/10/27	07:17:01	19.71	0.05
48	2016/10/27	07:18:01	19.72	0.02
49	2016/10/27	07:38:01	19.70	0.03
50	2016/10/27	07:39:01	19.60	0.04
51	2016/10/27	07:40:01	19.70	0.01
52	2016/10/27	07:41:01	19.70	0.01
53	2016/10/27	07:50:01	19.68	0.04
54	2016/10/27	07:51:01	19.23	0.01
55	2016/10/27	07:52:01	19.67	0.05
56	2016/10/27	07:53:01	19.70	0.04
57	2016/10/27	08:04:01	19.69	0.03
58	2016/10/27	08:05:01	19.64	0.04
59	2016/10/27	08:06:01	19.70	0.01
60	2016/10/27	08:07:01	19.67	0.03
61	2016/10/27	08:18:01	19.70	0.03
62	2016/10/27	08:19:01	19.50	0.03

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/27	08:20:01	19.70	0.01
64	2016/10/27	08:21:01	19.71	0.01
65	2016/10/27	08:32:01	19.71	0.02
66	2016/10/27	08:33:01	19.49	0.03
67	2016/10/27	08:34:01	19.73	0.01
68	2016/10/27	08:35:01	19.71	0.01
69	2016/10/27	08:48:01	19.71	0.03
70	2016/10/27	08:49:01	19.31	0.01
71	2016/10/27	08:50:01	19.69	0.02
72	2016/10/27	08:51:01	19.71	0.04
73	2016/10/27	09:35:01	19.69	0.04
74	2016/10/27	09:36:01	19.62	0.03
75	2016/10/27	09:37:01	19.69	0.01
76	2016/10/27	09:38:01	19.68	0.04
77	2016/10/27	09:47:01	19.68	0.02
78	2016/10/27	09:48:01	19.53	0.02
79	2016/10/27	09:49:01	19.68	0.04
80	2016/10/27	09:50:01	19.69	0.03
81	2016/10/27	09:58:01	19.67	0.01
82	2016/10/27	09:59:01	19.44	0.02
83	2016/10/27	10:00:01	19.68	0.05
84	2016/10/27	10:01:01	19.67	0.02
85	2016/10/27	10:11:01	19.65	0.04
86	2016/10/27	10:12:01	19.43	0.02
87	2016/10/27	10:13:01	19.67	0.03
88	2016/10/27	10:14:01	19.66	0.03
89	2016/10/27	10:36:01	19.62	0.04
90	2016/10/27	10:37:01	19.37	0.04
91	2016/10/27	10:38:01	19.63	0.02
92	2016/10/27	10:39:01	19.63	0.02
93	2016/10/27	10:52:01	19.60	0.02
94	2016/10/27	10:53:01	19.35	0.01
95	2016/10/27	10:54:01	19.59	0.04
96	2016/10/27	10:55:01	19.62	0.04
97	2016/10/27	11:07:01	19.61	0.01
98	2016/10/27	11:08:01	19.44	0.02
99	2016/10/27	11:09:01	19.61	0.04
100	2016/10/27	11:10:01	19.61	0.02
101	2016/10/27	11:20:01	19.61	0.04
102	2016/10/27	11:21:01	19.46	0.02
103	2016/10/27	11:22:01	19.59	0.02
104	2016/10/27	11:23:01	19.59	0.04
105	2016/10/27	12:13:01	19.60	0.02
106	2016/10/27	12:14:01	19.57	0.04
107	2016/10/27	12:15:01	19.63	0.02
108	2016/10/27	12:16:01	19.63	0.01
109	2016/10/27	12:35:01	19.64	0.03
110	2016/10/27	12:36:01	19.57	0.03
111	2016/10/27	12:37:01	19.61	0.03
112	2016/10/27	12:38:01	19.64	0.01
113	2016/10/27	12:47:01	19.64	0.04
114	2016/10/27	12:48:01	19.53	0.02
115	2016/10/27	12:49:01	19.66	0.02
116	2016/10/27	12:50:01	19.65	0.04
117	2016/10/27	12:59:01	19.65	0.01
118	2016/10/27	13:00:01	19.21	0.02
119	2016/10/27	13:01:01	19.64	0.08
120	2016/10/27	13:02:01	19.66	0.02
121	2016/10/27	13:14:01	19.66	0.01
122	2016/10/27	13:15:01	19.29	0.03
123	2016/10/27	13:16:01	19.63	0.05
124	2016/10/27	13:17:01	19.67	0.01
125	2016/10/27	13:27:01	19.67	0.04

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/27	13:28:01	19.30	0.01
127	2016/10/27	13:29:01	19.65	0.02
128	2016/10/27	13:30:01	19.67	0.04
129	2016/10/27	13:51:01	19.66	0.03
130	2016/10/27	13:52:01	19.24	0.04
131	2016/10/27	13:53:01	19.66	0.03
132	2016/10/27	13:54:01	19.66	0.01
133	2016/10/27	14:01:01	19.66	0.01
134	2016/10/27	14:02:01	19.36	0.03
135	2016/10/27	14:03:01	19.63	0.06
136	2016/10/27	14:04:01	19.66	0.02
137	2016/10/27	14:14:01	19.67	0.04
138	2016/10/27	14:15:01	19.57	0.01
139	2016/10/27	14:16:01	19.64	0.02
140	2016/10/27	14:17:01	19.66	0.04
141	2016/10/27	14:48:01	19.66	0.01
142	2016/10/27	14:49:01	19.59	0.03
143	2016/10/27	14:50:01	19.67	0.04
144	2016/10/27	14:51:01	19.68	0.02
145	2016/10/27	14:59:01	19.66	0.01
146	2016/10/27	15:00:01	19.39	0.03
147	2016/10/27	15:01:01	19.64	0.04
148	2016/10/27	15:02:01	19.67	0.02
149	2016/10/27	15:33:01	19.67	0.04
150	2016/10/27	15:34:01	19.27	0.03
151	2016/10/27	15:35:01	19.65	0.03
152	2016/10/27	15:36:01	19.68	0.02
153	2016/10/27	15:47:01	19.68	0.03
154	2016/10/27	15:48:01	19.39	0.05
155	2016/10/27	15:49:01	19.68	0.03
156	2016/10/27	15:50:01	19.69	0.01
157	2016/10/27	15:59:01	19.70	0.04
158	2016/10/27	16:00:01	19.34	0.01
159	2016/10/27	16:01:01	19.68	0.04
160	2016/10/27	16:02:01	19.70	0.04
161	2016/10/27	16:13:01	19.70	0.04
162	2016/10/27	16:14:01	19.49	0.03
163	2016/10/27	16:15:01	19.69	0.02
164	2016/10/27	16:16:01	19.69	0.03
165	2016/10/27	16:26:01	19.71	0.01
166	2016/10/27	16:27:01	19.53	0.04
167	2016/10/27	16:28:01	19.63	0.04
168	2016/10/27	16:29:01	19.70	0.01
169	2016/10/27	16:39:01	19.69	0.03
170	2016/10/27	16:40:01	19.35	0.01
171	2016/10/27	16:41:01	19.66	0.03
172	2016/10/27	16:42:01	19.70	0.04
173	2016/10/27	16:54:01	19.72	0.02
174	2016/10/27	16:55:01	19.54	0.01
175	2016/10/27	16:56:01	19.72	0.04
176	2016/10/27	16:57:01	19.74	0.04
177	2016/10/27	17:07:01	19.75	0.04
178	2016/10/27	17:08:01	19.58	0.03
179	2016/10/27	17:09:01	19.70	0.02
180	2016/10/27	17:10:01	19.75	0.02
RUN 1 AVERAGES			**19.95**	**0.03**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	
Run 3					
1	2016/11/01	10:32:01	20.62	0.16	
2	2016/11/01	10:33:01	20.49	0.29	
3	2016/11/01	10:34:01	20.47	0.28	
4	2016/11/01	10:35:01	20.60	0.17	
5	2016/11/01	10:43:01	20.62	0.17	
6	2016/11/01	10:44:01	20.52	0.18	
7	2016/11/01	10:45:01	20.65	0.19	
8	2016/11/01	10:46:01	20.65	0.20	
9	2016/11/01	11:02:01	Calibrations	being	performed
10	2016/11/01	11:03:01	Calibrations	being	performed
11	2016/11/01	11:04:01	Calibrations	being	performed
12	2016/11/01	11:05:01	Calibrations	being	performed
13	2016/11/01	11:13:01	20.48	0.17	
14	2016/11/01	11:14:01	20.30	0.31	
15	2016/11/01	11:15:01	20.40	0.18	
16	2016/11/01	11:16:01	20.45	0.17	
17	2016/11/01	11:56:01	20.81	0.16	
18	2016/11/01	11:57:01	20.66	0.30	
19	2016/11/01	11:58:01	20.66	0.24	
20	2016/11/01	11:59:01	20.75	0.17	
21	2016/11/01	12:10:01	20.84	0.16	
22	2016/11/01	12:11:01	20.74	0.26	
23	2016/11/01	12:12:01	20.68	0.26	
24	2016/11/01	12:13:01	20.77	0.17	
25	2016/11/01	12:23:01	20.83	0.16	
26	2016/11/01	12:24:01	20.60	0.36	
27	2016/11/01	12:25:01	20.74	0.19	
28	2016/11/01	12:26:01	20.77	0.16	
29	2016/11/01	12:37:01	20.83	0.16	
30	2016/11/01	12:38:01	20.58	0.37	
31	2016/11/01	12:39:01	20.76	0.18	
32	2016/11/01	12:40:01	20.79	0.16	
33	2016/11/01	12:50:01	20.82	0.16	
34	2016/11/01	12:51:01	20.72	0.23	
35	2016/11/01	12:52:01	20.64	0.29	
36	2016/11/01	12:53:01	20.77	0.16	
37	2016/11/01	13:06:01	Calibrations	being	performed
38	2016/11/01	13:07:01	Calibrations	being	performed
39	2016/11/01	13:08:01	Calibrations	being	performed
40	2016/11/01	13:09:01	Calibrations	being	performed
41	2016/11/01	13:15:01	20.86	0.16	
42	2016/11/01	13:16:01	20.69	0.32	
43	2016/11/01	13:17:01	20.62	0.34	
44	2016/11/01	13:18:01	20.83	0.16	
45	2016/11/01	13:28:01	20.87	0.16	
46	2016/11/01	13:29:01	20.72	0.30	
47	2016/11/01	13:30:01	20.73	0.25	
48	2016/11/01	13:31:01	20.83	0.16	
49	2016/11/01	13:43:01	20.45	0.42	
50	2016/11/01	13:44:01	20.75	0.17	
51	2016/11/01	13:45:01	20.79	0.16	
52	2016/11/01	13:46:01	20.81	0.16	
53	2016/11/01	14:15:01	20.87	0.15	
54	2016/11/01	14:16:01	20.82	0.20	
55	2016/11/01	14:17:01	20.57	0.40	
56	2016/11/01	14:18:01	20.79	0.17	
57	2016/11/01	14:28:01	20.85	0.16	
58	2016/11/01	14:29:01	20.60	0.37	
59	2016/11/01	14:30:01	20.81	0.16	
60	2016/11/01	14:31:01	20.84	0.15	
61	2016/11/01	14:41:01	20.86	0.15	
62	2016/11/01	14:42:01	20.58	0.41	

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/11/01	14:43:01	20.77	0.19
64	2016/11/01	14:44:01	20.84	0.15
65	2016/11/01	14:54:01	20.86	0.16
66	2016/11/01	14:55:01	20.64	0.33
67	2016/11/01	14:56:01	20.82	0.16
68	2016/11/01	14:57:01	20.84	0.15
69	2016/11/01	15:05:01	20.86	0.15
70	2016/11/01	15:06:01	20.65	0.36
71	2016/11/01	15:07:01	20.69	0.26
72	2016/11/01	15:08:01	20.81	0.15
73	2016/11/01	15:18:01	20.87	0.15
74	2016/11/01	15:19:01	20.76	0.24
75	2016/11/01	15:20:01	20.74	0.23
76	2016/11/01	15:21:01	20.83	0.15
77	2016/11/01	15:36:01	20.86	0.15
78	2016/11/01	15:37:01	20.69	0.32
79	2016/11/01	15:38:01	20.75	0.21
80	2016/11/01	15:39:01	20.83	0.15
81	2016/11/01	15:50:01	20.86	0.14
82	2016/11/01	15:51:01	20.61	0.36
83	2016/11/01	15:52:01	20.80	0.16
84	2016/11/01	15:53:01	20.83	0.15
85	2016/11/01	16:02:01	20.81	0.14
86	2016/11/01	16:03:01	20.58	0.36
87	2016/11/01	16:04:01	20.74	0.19
88	2016/11/01	16:05:01	20.80	0.14
89	2016/11/01	16:48:01	20.88	0.14
90	2016/11/01	16:49:01	20.63	0.35
91	2016/11/01	16:50:01	20.81	0.16
92	2016/11/01	16:51:01	20.82	0.15
93	2016/11/01	16:59:01	20.85	0.15
94	2016/11/01	17:00:01	20.69	0.29
95	2016/11/01	17:01:01	20.75	0.19
96	2016/11/01	17:02:01	20.82	0.15
97	2016/11/01	17:14:01	20.87	0.15
98	2016/11/01	17:15:01	20.62	0.36
99	2016/11/01	17:16:01	20.81	0.16
100	2016/11/01	17:17:01	20.83	0.15
101	2016/11/01	17:26:01	20.87	0.15
102	2016/11/01	17:27:01	20.65	0.33
103	2016/11/01	17:28:01	20.80	0.17
104	2016/11/01	17:29:01	20.84	0.15
105	2016/11/01	17:39:01	20.85	0.16

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
106	2016/11/01	17:40:01	20.66	0.29
107	2016/11/01	17:41:01	20.82	0.16
108	2016/11/01	17:42:01	20.84	0.15
109	2016/11/01	17:52:01	20.60	0.28
110	2016/11/01	17:53:01	20.77	0.18
111	2016/11/01	17:54:01	20.80	0.17
112	2016/11/01	17:55:01	20.81	0.16
113	2016/11/01	18:04:01	20.86	0.16
114	2016/11/01	18:05:01	20.64	0.34
115	2016/11/01	18:06:01	20.80	0.17
116	2016/11/01	18:07:01	20.84	0.16
117	2016/11/01	18:16:01	20.87	0.16
118	2016/11/01	18:17:01	20.76	0.27
119	2016/11/01	18:18:01	20.73	0.25
120	2016/11/01	18:19:01	20.82	0.16
121	2016/11/01	18:30:01	20.88	0.16
122	2016/11/01	18:31:01	20.71	0.29
123	2016/11/01	18:32:01	20.83	0.17
124	2016/11/01	18:33:01	20.86	0.16
125	2016/11/01	19:12:01	20.91	0.16
126	2016/11/01	19:13:01	20.85	0.22
127	2016/11/01	19:14:01	20.75	0.26
128	2016/11/01	19:15:01	20.84	0.17
129	2016/11/01	19:25:01	20.90	0.17
130	2016/11/01	19:26:01	20.71	0.33
131	2016/11/01	19:27:01	20.82	0.18
132	2016/11/01	19:28:01	20.87	0.17
133	2016/11/01	19:38:01	20.90	0.17
134	2016/11/01	19:39:01	20.75	0.31
135	2016/11/01	19:40:01	20.82	0.20
136	2016/11/01	19:41:01	20.87	0.17
137	2016/11/01	19:53:01	20.90	0.17
138	2016/11/01	19:54:01	20.75	0.31
139	2016/11/01	19:55:01	20.82	0.19
140	2016/11/01	19:56:01	20.87	0.17
141	2016/11/01	20:05:01	20.91	0.17
142	2016/11/01	20:06:01	20.72	0.32
143	2016/11/01	20:07:01	20.84	0.18
144	2016/11/01	20:08:01	20.86	0.17
145	2016/11/01	20:18:01	20.91	0.17
146	2016/11/01	20:19:01	20.73	0.32
147	2016/11/01	20:20:01	20.85	0.18
148	2016/11/01	20:21:01	20.88	0.17
149	2016/11/01	20:30:01	20.91	0.17
150	2016/11/01	20:31:01	20.73	0.31
151	2016/11/01	20:32:01	20.83	0.19
152	2016/11/01	20:33:01	20.87	0.17
153	2016/11/01	20:43:01	20.91	0.17
154	2016/11/01	20:44:01	20.79	0.26
155	2016/11/01	20:45:01	20.80	0.21
156	2016/11/01	20:46:01	20.87	0.17
157	2016/11/01	21:04:01	20.92	0.17
158	2016/11/01	21:05:01	20.79	0.30
159	2016/11/01	21:06:01	20.82	0.23
160	2016/11/01	21:07:01	20.87	0.18
161	2016/11/01	21:41:01	20.89	0.16
162	2016/11/01	21:42:01	20.87	0.18
163	2016/11/01	21:43:01	20.74	0.27
164	2016/11/01	21:44:01	20.84	0.16
165	2016/11/01	21:55:01	20.89	0.15
166	2016/11/01	21:56:01	20.69	0.33
167	2016/11/01	21:57:01	20.83	0.16
168	2016/11/01	21:58:01	20.87	0.15

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
169	2016/11/01	22:05:01	20.89	0.15
170	2016/11/01	22:06:01	20.75	0.29
171	2016/11/01	22:07:01	20.80	0.19
172	2016/11/01	22:08:01	20.85	0.15
173	2016/11/01	22:16:01	20.88	0.15
174	2016/11/01	22:17:01	20.71	0.30
175	2016/11/01	22:18:01	20.82	0.17
176	2016/11/01	22:19:01	20.85	0.15
177	2016/11/01	22:28:01	20.88	0.13
178	2016/11/01	22:29:01	20.73	0.27
179	2016/11/01	22:30:01	20.81	0.16
180	2016/11/01	22:31:01	20.84	0.13
RUN 3 AVERAGES			**20.77**	**0.21**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 4				
1	2016/11/01	23:42:01	20.68	0.36
2	2016/11/01	23:43:01	20.83	0.18
3	2016/11/01	23:44:01	20.85	0.16
4	2016/11/01	23:45:01	20.87	0.16
5	2016/11/01	23:53:01	20.64	0.40
6	2016/11/01	23:54:01	20.82	0.19
7	2016/11/01	23:55:01	20.86	0.16
8	2016/11/01	23:56:01	20.87	0.16
9	2016/11/02	00:05:01	20.91	0.18
10	2016/11/02	00:06:01	20.70	0.34
11	2016/11/02	00:07:01	20.87	0.18
12	2016/11/02	00:08:01	20.90	0.17
13	2016/11/02	00:41:01	20.97	0.20
14	2016/11/02	00:42:01	20.77	0.36
15	2016/11/02	00:43:01	20.92	0.20
16	2016/11/02	00:44:01	20.94	0.19
17	2016/11/02	00:54:01	20.85	0.29
18	2016/11/02	00:55:01	20.80	0.30
19	2016/11/02	00:56:01	20.93	0.20
20	2016/11/02	00:57:01	20.94	0.19
21	2016/11/02	01:14:01	20.84	0.29
22	2016/11/02	01:15:01	20.85	0.26
23	2016/11/02	01:16:01	20.91	0.20
24	2016/11/02	01:17:01	20.94	0.19
25	2016/11/02	02:30:01	20.99	0.19
26	2016/11/02	02:31:01	20.82	0.33
27	2016/11/02	02:32:01	20.92	0.21
28	2016/11/02	02:33:01	20.94	0.19
29	2016/11/02	02:45:01	20.85	0.31
30	2016/11/02	02:46:01	20.83	0.29
31	2016/11/02	02:47:01	20.93	0.20
32	2016/11/02	02:48:01	20.94	0.19
33	2016/11/02	02:59:01	20.97	0.19
34	2016/11/02	03:00:01	20.75	0.39
35	2016/11/02	03:01:01	20.92	0.21
36	2016/11/02	03:02:01	20.94	0.19
37	2016/11/02	03:10:01	20.89	0.28
38	2016/11/02	03:11:01	20.79	0.34
39	2016/11/02	03:12:01	20.92	0.20
40	2016/11/02	03:13:01	20.95	0.19
41	2016/11/02	03:22:01	20.97	0.20
42	2016/11/02	03:23:01	20.76	0.37
43	2016/11/02	03:24:01	20.93	0.20
44	2016/11/02	03:25:01	20.95	0.19
45	2016/11/02	03:32:01	20.91	0.25
46	2016/11/02	03:33:01	20.75	0.37
47	2016/11/02	03:34:01	20.93	0.20
48	2016/11/02	03:35:01	20.95	0.19
49	2016/11/02	03:43:01	20.97	0.19
50	2016/11/02	03:44:01	20.76	0.37
51	2016/11/02	03:45:01	20.92	0.21
52	2016/11/02	03:46:01	20.95	0.19
53	2016/11/02	04:18:01	20.97	0.21
54	2016/11/02	04:19:01	20.79	0.36
55	2016/11/02	04:20:01	20.93	0.20
56	2016/11/02	04:21:01	20.95	0.19
57	2016/11/02	04:29:01	20.97	0.19
58	2016/11/02	04:30:01	20.83	0.33
59	2016/11/02	04:31:01	20.86	0.27
60	2016/11/02	04:32:01	20.94	0.20
61	2016/11/02	04:39:01	20.97	0.19
62	2016/11/02	04:40:01	20.75	0.40

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/11/02	04:41:01	20.92	0.21
64	2016/11/02	04:42:01	20.94	0.19
65	2016/11/02	04:51:01	20.97	0.20
66	2016/11/02	04:52:01	20.77	0.36
67	2016/11/02	04:53:01	20.93	0.20
68	2016/11/02	04:54:01	20.94	0.19
69	2016/11/02	05:02:01	20.79	0.34
70	2016/11/02	05:03:01	20.90	0.22
71	2016/11/02	05:04:01	20.94	0.19
72	2016/11/02	05:05:01	20.95	0.19
73	2016/11/02	05:16:01	20.91	0.24
74	2016/11/02	05:17:01	20.81	0.31
75	2016/11/02	05:18:01	20.94	0.19
76	2016/11/02	05:19:01	20.95	0.19
77	2016/11/02	05:29:01	20.75	0.38
78	2016/11/02	05:30:01	20.91	0.22
79	2016/11/02	05:31:01	20.93	0.19
80	2016/11/02	05:32:01	20.94	0.19
81	2016/11/02	05:45:01	20.83	0.30
82	2016/11/02	05:46:01	20.94	0.19
83	2016/11/02	05:47:01	20.96	0.19
84	2016/11/02	05:48:01	20.96	0.19
85	2016/11/02	05:56:01	20.74	0.40
86	2016/11/02	05:57:01	20.92	0.21
87	2016/11/02	05:58:01	20.95	0.19
88	2016/11/02	05:59:01	20.96	0.19
89	2016/11/02	06:11:01	20.73	0.38
90	2016/11/02	06:12:01	20.93	0.20
91	2016/11/02	06:13:01	20.95	0.19
92	2016/11/02	06:14:01	20.96	0.19
93	2016/11/02	06:25:01	20.96	0.22
94	2016/11/02	06:26:01	20.76	0.37
95	2016/11/02	06:27:01	20.92	0.20
96	2016/11/02	06:28:01	20.94	0.19
97	2016/11/02	06:38:01	20.82	0.35
98	2016/11/02	06:39:01	20.86	0.28

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
99	2016/11/02	06:40:01	20.95	0.19
100	2016/11/02	06:41:01	20.96	0.19
101	2016/11/02	06:50:01	20.89	0.28
102	2016/11/02	06:51:01	20.85	0.29
103	2016/11/02	06:52:01	20.95	0.19
104	2016/11/02	06:53:01	20.96	0.19
105	2016/11/02	07:42:01	20.74	0.16
106	2016/11/02	07:43:01	20.50	0.36
107	2016/11/02	07:44:01	20.67	0.18
108	2016/11/02	07:45:01	20.69	0.16
109	2016/11/02	07:56:01	20.70	0.18
110	2016/11/02	07:57:01	20.35	0.54
111	2016/11/02	07:58:01	20.52	0.34
112	2016/11/02	07:59:01	20.65	0.18
113	2016/11/02	08:09:01	20.72	0.16
114	2016/11/02	08:10:01	20.48	0.38
115	2016/11/02	08:11:01	20.65	0.18
116	2016/11/02	08:12:01	20.69	0.16
117	2016/11/02	08:24:01	20.73	0.16
118	2016/11/02	08:25:01	20.46	0.41
119	2016/11/02	08:26:01	20.64	0.19
120	2016/11/02	08:27:01	20.70	0.16
121	2016/11/02	09:07:01	20.57	0.32
122	2016/11/02	09:08:01	20.65	0.21
123	2016/11/02	09:09:01	20.69	0.17
124	2016/11/02	09:10:01	20.71	0.16
125	2016/11/02	09:23:01	20.74	0.17
126	2016/11/02	09:24:01	20.51	0.37
127	2016/11/02	09:25:01	20.66	0.20
128	2016/11/02	09:26:01	20.70	0.17
129	2016/11/02	09:37:01	20.74	0.17
130	2016/11/02	09:38:01	20.50	0.37
131	2016/11/02	09:39:01	20.68	0.18
132	2016/11/02	09:40:01	20.70	0.17
133	2016/11/02	09:52:01	20.73	0.17
134	2016/11/02	09:53:01	20.53	0.35
135	2016/11/02	09:54:01	20.64	0.22
136	2016/11/02	09:55:01	20.70	0.17
137	2016/11/02	10:05:01	20.65	0.25
138	2016/11/02	10:06:01	20.58	0.27
139	2016/11/02	10:07:01	20.69	0.17
140	2016/11/02	10:08:01	20.71	0.17
141	2016/11/02	10:18:01	20.68	0.21
142	2016/11/02	10:19:01	20.50	0.35
143	2016/11/02	10:20:01	20.68	0.18
144	2016/11/02	10:21:01	20.71	0.17
145	2016/11/02	10:30:01	20.73	0.17
146	2016/11/02	10:31:01	20.54	0.34
147	2016/11/02	10:32:01	20.65	0.19
148	2016/11/02	10:33:01	20.69	0.17
149	2016/11/02	10:42:01	20.74	0.16
150	2016/11/02	10:43:01	20.49	0.39
151	2016/11/02	10:44:01	20.62	0.22
152	2016/11/02	10:45:01	20.70	0.17
153	2016/11/02	10:55:01	20.72	0.17
154	2016/11/02	10:56:01	20.51	0.34
155	2016/11/02	10:57:01	20.68	0.17
156	2016/11/02	10:58:01	20.71	0.17
157	2016/11/02	11:53:01	20.73	0.16
158	2016/11/02	11:54:01	20.49	0.38
159	2016/11/02	11:55:01	20.66	0.18
160	2016/11/02	11:56:01	20.69	0.16
161	2016/11/02	12:07:01	20.68	0.22

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	
162	2016/11/02	12:08:01	20.54	0.31	
163	2016/11/02	12:09:01	20.67	0.16	
164	2016/11/02	12:10:01	20.71	0.16	
165	2016/11/02	12:21:01	Calibrations	being	performed
166	2016/11/02	12:22:01	Calibrations	being	performed
167	2016/11/02	12:23:01	Calibrations	being	performed
168	2016/11/02	12:24:01	Calibrations	being	performed
169	2016/11/02	12:36:01	20.42	0.43	
170	2016/11/02	12:37:01	20.64	0.17	
171	2016/11/02	12:38:01	20.68	0.16	
172	2016/11/02	12:39:01	20.69	0.16	
173	2016/11/02	12:47:01	20.71	0.15	
174	2016/11/02	12:48:01	20.42	0.42	
175	2016/11/02	12:49:01	20.62	0.19	
176	2016/11/02	12:50:01	20.67	0.15	
177	2016/11/02	13:00:01	20.66	0.19	
178	2016/11/02	13:01:01	20.45	0.36	
179	2016/11/02	13:02:01	20.64	0.16	
180	2016/11/02	13:03:01	20.67	0.15	
RUN 4 AVERAGES			**20.78**	**0.23**	

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

Client	ArcelorMittal	**Date**	Oct. 27, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 1
Unit	Quench Tower	**Start Time**	3:29
Operation	Normal	**End Time**	16:40
Tester(s)	JV, JW, TM, TL		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	44	45
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	45	44
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	0.14	0.40	0.17	0.55	0.15	20.01	0.16			
	Mid	10.21	10.17	9.99	-0.90	10.12	-0.25	0.65	20.01	10.06	19.95	20.42	d. vol. %
CO2	Zero		0.05	-0.02	-0.35	-0.05	-0.50	-0.15	19.81	-0.04			
	Mid	10.08	9.89	9.75	-0.71	9.74	-0.76	-0.05	19.81	9.75	0.03	0.06	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Nov. 1, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	10:32
Operation	Normal	**End Time**	22:28
Tester(s)	JV, JW, TM, TL		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
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	0.17	0.55	-0.15	-1.05	-1.60	20.01	0.01			
	Mid	10.21	10.17	10.12	-0.25	10.26	0.45	0.70	20.01	10.19	20.77	20.82	d. vol. %
CO2	Zero		0.05	-0.05	-0.50	0.15	0.50	1.01	19.81	0.05			
	Mid	10.08	9.89	9.74	-0.76	9.98	0.45	1.21	19.81	9.86	0.21	0.16	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Nov. 1-2, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 4
Unit	Quench Tower	**Start Time**	23:41
Operation	Normal	**End Time**	13:03
Tester(s)	JV, JW, TM, TL		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
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		0.00	-0.15	-0.75	-0.04	-0.20	0.55	20.01	-0.10			
	Mid	10.21	10.17	10.26	0.45	10.16	-0.05	-0.50	20.01	10.21	20.78	20.69	d. vol. %
CO2	Zero		0.20	0.15	-0.25	0.11	-0.45	-0.20	19.81	0.13			
	Mid	10.08	9.89	9.98	0.45	9.92	0.15	-0.30	19.81	9.95	0.23	0.11	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.0	0.00					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.2	1.01					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal	Test Date:	Oct. 27, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Quench Tower	Test Start Time:	3:29 AM
Unit Operation:	Normal	Test Finish Time:	4:40 PM

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

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	180	mimutes
Barometric Pressure (Pbar)	29.14	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.476	inches
O2	20.42	% dv
CO2	0.06	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Semi-vols Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	75.4	F
Stack Temperature (Tsavg)	176.7	F
Orifice Pressure Drop (dHavg)	2.732	in. H_2O
GasVelocity Head (dP)^^avg	0.2775	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
Total Test Time	13.18	hours
# of quenches	72	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	mimutes/quench

Calculations

CO + N2	79.52	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	644.7	g
Water Vapor in Silica Gel (Vwsg(std))	30.398	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	30.398	scf
Volume Dry Gas Metered (Vm)	163.921	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	159.400	dscf
Volume Dry Gas Metered (Vm(m^3))	4.642	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.514	dscm
Stack Absolute Pressure (Ps)	29.14	in. Hg
Stack Absolute Temperature (Tsavg)	636.4	R
H2O Vapor Pressure @ avg Stack Temp.	14.23	in. Hg
H2O in the gas at saturation (Bws)	0.4885	vol. fraction
H2O in the gas from test data (Bws)	0.1602	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1602	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.83	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.09	lb/lb-mole
Gas Velocity (Vs)	17.90	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	966.435	acfm
Standard Gas Flowrate	780.523	scfm
Dry Standard Gas Flowrate	655.517	dscfm
Dry Standard Exhaust Gas Flowrate	2.942.6	1000 lb/hr
Actual Gas Flowrate	27.367	acm/min
Standard Gas Flowrate	22.102	scm/min
Dry Standard Gas Flowrate	18.562	dscm/min
Area Nozzle (An)	0.001236	ft^2
Percent of Isokinetic Sampling (I)	98.44	%

Dioxin Furan

	Analyte		TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
1	2378-TCDD	<	1	3.2	0.0032	0.0032
2	12378-PeCDD	<	0.5	5.6	0.0056	0.0028
3	123478-HxCDD	<	0.1	3.6	0.0036	0.00036
4	123678-HxCDD		0.1	11	0.0110	0.0011
5	123789-HxCDD		0.1	13.2	0.0132	0.00132
6	1234678-HpCDD		0.01	289	0.2890	0.00289
1	2378-TCDF (DB 225)		0.1	28.8	0.0288	0.00288
2	12378-PeCDF	<	0.05	4.4	0.0044	0.00022
3	23478-PeCDF	<	0.5	4.4	0.0044	0.0022
4	123478-HxCDF		0.1	7.6	0.0076	0.00076
5	123678-HxCDF	<	0.1	2.9	0.0029	0.00029
6	234678-HxCDF		0.1	3.9	0.0039	0.00039
7	123789-HxCDF	<	0.1	3.3	0.0033	0.00033
8	1234678-HpCDF		0.01	19.7	0.0197	0.000197
9	1234789-HpCDF	<	0.01	3.9	0.0039	0.000039
					TEF ADJUSTED TOTAL	0.019

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

TEF Total Mass Collected	<	0.019	ng
TEF Emission Concentration	<	0.0042	ng/m^3
TEF Emission Rate	<	N/A	ng/hr
Emission Rate	<	N/A	gr/hr
Emission Rate	<	N/A	lb/hr

ArcelorMittal Quench Tower **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	0.080	0.283	2.84	165	67	67
A-1	0.080	0.283	2.84	159	66	67
A-1	0.081	0.285	2.80	158	66	67
A-2	0.075	0.274	2.70	160	66	67
A-2	0.075	0.274	2.70	171	66	66
A-2	0.072	0.268	2.60	170	66	66
A-3	0.075	0.274	2.70	168	67	67
A-3	0.075	0.274	2.70	168	67	67
A-3	0.075	0.274	2.70	168	68	67
A-4	0.080	0.283	2.80	168	67	67
A-4	0.080	0.283	2.80	170	67	67
A-4	0.072	0.268	2.60	172	66	69
A-5	0.080	0.283	2.80	170	68	69
A-5	0.080	0.283	2.80	159	68	70
A-5	0.072	0.268	2.60	168	69	70
A-6	0.072	0.268	2.60	170	69	70
A-6	0.068	0.261	2.40	169	70	70
A-6	0.068	0.261	2.40	180	70	70
B-1	0.068	0.261	2.40	183	70	70
B-1	0.080	0.283	2.80	185	70	74
B-1	0.080	0.283	2.80	180	71	76
B-2	0.080	0.283	2.80	182	71	77
B-2	0.074	0.272	2.60	174	71	75
B-2	0.078	0.279	2.80	178	71	75
B-3	0.081	0.285	2.90	185	77	75
B-3	0.079	0.281	2.80	185	76	75
B-3	0.085	0.292	3.00	179	76	75
B-4	0.072	0.268	2.60	183	76	75
B-4	0.080	0.283	2.80	177	76	75
B-4	0.085	0.292	3.00	181	76	75
B-5	0.071	0.266	2.50	184	76	75
B-5	0.084	0.290	3.00	178	76	75
B-5	0.083	0.288	2.90	180	77	75
B-6	0.077	0.277	2.70	175	78	76
B-6	0.084	0.290	3.00	182	78	76
B-6	0.080	0.283	2.80	178	79	76
C-1	0.072	0.268	2.60	172	79	76
C-1	0.074	0.272	2.60	179	80	77
C-1	0.081	0.285	2.90	183	81	78
C-2	0.082	0.286	2.90	178	81	78
C-2	0.075	0.2739	2.70	174	81	79
C-2	0.079	0.2811	2.80	180	81	79
C-3	0.089	0.2983	3.00	175	82	80
C-3	0.072	0.2683	2.60	172	84	81
C-3	0.080	0.2828	2.80	179	84	81
C-4	0.080	0.2828	2.80	184	85	82
C-4	0.076	0.2757	2.70	180	79	79
C-4	0.073	0.2702	2.60	186	79	78
C-5	0.070	0.2646	2.50	174	79	78
C-5	0.078	0.2793	2.80	173	79	78
C-5	0.069	0.2627	2.40	182	80	78
C-6	0.077	0.2775	2.70	186	80	78
C-6	0.077	0.2775	2.70	189	80	79
C-6	0.081	0.2846	2.90	180	80	78
D-1	0.077	0.2775	2.70	174	80	79
D-1	0.073	0.2702	2.60	182	80	78
D-1	0.069	0.2627	2.40	177	80	79
D-2	0.078	0.2793	2.80	180	80	78
D-2	0.072	0.2683	2.60	179	80	79
D-2	0.080	0.2828	2.80	184	80	79
D-3	0.077	0.2775	2.70	185	80	79
D-3	0.075	0.2739	2.70	180	80	78
D-3	0.070	0.2646	2.50	172	80	79
D-4	0.078	0.2793	2.80	182	80	79
D-4	0.084	0.2898	3.00	185	80	78
D-4	0.079	0.2811	2.80	179	80	78
D-5	0.077	0.2775	2.70	181	80	79
D-5	0.084	0.2898	3.00	178	80	79
D-5	0.081	0.2846	2.90	175	81	79
D-6	0.073	0.2702	2.60	184	82	79
D-6	0.080	0.2828	2.80	179	81	79
D-6	0.077	0.2775	2.70	181	81	79
Average	0.08	0.2775	2.73	176.7		75.4

Initial volume	303.100	ft^3	Initial volume	0.000	liters
Final volume	467.021	ft^3	Final volume	0.000	liters
Total metered	163.921	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	936.4	348.4	588.0			0.0
2	691.0	687.4	3.6			0.0
3	709.8	704.4	5.4			0.0
4	621.3	618.4	2.9			0.0
5	822.5	777.7	44.8			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	3781.0	3136.3	644.7	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:	Oct. 27, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Quench Tower	Test Start Time:	3:29 AM
Unit Operation:	Normal	Test Finish Time:	4:40 PM

USEPA Method 23 Individual Emission Rates

Compound		Mass (pg)	Mass (µg)	Adjusted TEF Mass (µg)	Raw Concentration (µg/m³)	Raw ER (lb/hr)	TEF Conc. (µg/m³)	TEF Emissions (lb/hr)
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	<	3.2	0.0000032	0.0000032	7.1E-07	N/A	7.1E-07	NA
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	5.6	0.0000056	0.0000028	1.2E-06	N/A	6.2E-07	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.6	0.0000036	0.00000036	8.0E-07	N/A	8.0E-08	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin		11	0.000011	0.0000011	2.4E-06	N/A	2.4E-07	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin		13.2	0.0000132	0.00000132	2.9E-06	N/A	2.9E-07	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		289	0.000289	0.00000289	6.4E-05	N/A	6.4E-07	NA
2,3,7,8-Tetrachlorodibenzofuran		37.7	0.0000377	0.00000288	8.4E-06	N/A	6.4E-07	NA
1,2,3,7,8-Pentachlorodibenzofuran	<	4.4	0.0000044	0.00000022	9.7E-07	N/A	4.9E-08	NA
2,3,4,7,8-Pentachlorodibenzofuran	<	4.4	0.0000044	0.0000022	9.7E-07	N/A	4.9E-07	NA
1,2,3,4,7,8-Hexachlorodibenzofuran		7.6	0.0000076	0.00000076	1.7E-06	N/A	1.7E-07	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	<	2.9	0.0000029	0.00000029	6.4E-07	N/A	6.4E-08	NA
2,3,4,6,7,8-Hexachlorodibenzofuran		3.9	0.0000039	0.00000039	8.6E-07	N/A	8.6E-08	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	<	3.3	0.0000033	0.00000033	7.3E-07	N/A	7.3E-08	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran		19.7	0.0000197	0.000000197	4.4E-06	N/A	4.4E-08	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.9	0.0000039	0.000000039	8.6E-07	N/A	8.6E-09	NA
								NA

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene		30	0.0066	NA
Acenaphthylene		69	0.0153	NA
Anthracene		33	0.0073	NA
Benz[a]anthracene	<	20	0.0044	NA
Benzo[a]pyrene	<	20	0.0044	NA
Benzo[b]fluoranthene	<	20	0.0044	NA
Benzo[g,h,i]perylene	<	20	0.0044	NA
Benzo[k]fluoranthene	<	20	0.0044	NA
Chrysene	<	20	0.0044	NA
Dibenz[a,h]anthracene	<	20	0.0044	NA
Fluoranthene		52	0.0115	NA
Fluorene		58	0.0128	NA
Indeno (1,2,3-cd) pyrene	<	20	0.0044	NA
Naphthalene		228	0.0505	NA
Phenanthrene		156	0.0346	NA
Perylene	<	15	0.0033	NA
Pyrene		46	0.0102	NA

Client:	ArcelorMittal	Test Date:	Nov. 1, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Quench Tower	Test Start Time:	10:32 AM
Unit Operation:	Normal	Test Finish Time:	10:28 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:	1936	
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O
Meter Calibration Factor (Yd)	0.998	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.30	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.476	inches
O2	20.82	% dv
CO2	0.16	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Semi-vols 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)	73.1	F
Stack Temperature (Tsavg)	178.4	F
Orifice Pressure Drop (dHavg)	2.581	in. H_2O
GasVelocity Head (dP)^^avg	0.2798	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
Total Test Time	11.93	hours
# of quenches	36	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	79.02	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	567.1	g
Water Vapor in Silica Gel (Vwsg(std))	26.739	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	26.739	scf
Volume Dry Gas Metered (Vm)	166.006	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	161.653	dscf
Volume Dry Gas Metered (Vm(m^3))	4.701	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.578	dscm
Stack Absolute Pressure (Ps)	29.30	in. Hg
Stack Absolute Temperature (Tsavg)	638.0	R
H2O Vapor Pressure @ avg Stack Temp.	14.76	in. Hg
H2O in the gas at saturation (Bws)	0.5038	vol. fraction
H2O in the gas from test data (Bws)	0.1419	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1419	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.86	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.32	lb/lb-mole
Gas Velocity (Vs)	17.94	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	968,835	acfm
Standard Gas Flowrate	784,756	scfm
Dry Standard Gas Flowrate	673,374	dscfm
Dry Standard Exhaust Gas Flowrate	3,026.1	1000 lb/hr
Actual Gas Flowrate	27,434	acm/min
Standard Gas Flowrate	22,222	scm/min
Dry Standard Gas Flowrate	19,068	dscm/min
Area Nozzle (An)	0.001236	ft^2
Percent of Isokinetic Sampling (I)	97.19	%

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	4.3	0.0043	0.00215
123478-HxCDD	<	0.1	3.2	0.0032	0.00032
123678-HxCDD		0.1	11.6	0.0116	0.00116
123789-HxCDD		0.1	16.5	0.0165	0.00165
1234678-HpCDD		0.01	215	0.2150	0.00215
2378-TCDF (DB 225)		0.1	7.2	0.0072	0.00072
12378-PeCDF	<	0.05	4.4	0.0044	0.00022
23478-PeCDF	<	0.5	4.4	0.0044	0.0022
123478-HxCDF	<	0.1	4.1	0.0041	0.00041
123678-HxCDF	<	0.1	3.9	0.0039	0.00039
234678-HxCDF	<	0.1	4.3	0.0043	0.00043
123789-HxCDF	<	0.1	4.5	0.0045	0.00045
1234678-HpCDF		0.01	8.3	0.0083	0.000083
1234789-HpCDF	<	0.01	3.5	0.0035	0.000035

TEF Factors taken from USEPA 40 CFR, Chapter 1, Part 266, Appendix IX, Table 4.0.1 — TEF ADJUSTED TOTAL 0.016

TEF Total Mass Collected	<	0.016	ng
TEF Emission Concentration	<	0.003	ng/m^3
TEF Emission Rate	<	N/A	ng/hr
Emission Rate	<	N/A	gr/hr
Emission Rate	<	N/A	lb/hr

ArcelorMittal **Run 3** **F or C?**
Quench Tower **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	0.078	0.279	2.6	179	66	66
A-1	0.075	0.274	2.5	183	65	66
A-1	0.081	0.285	2.7	175	65	66
A-2	0.076	0.276	2.5	179	67	67
A-2	0.083	0.288	2.7	188	67	67
A-2	0.081	0.285	2.7	186	68	68
A-3	0.077	0.277	2.5	179	70	68
A-3	0.080	0.283	2.6	181	70	69
A-3	0.082	0.286	2.7	189	72	71
B-1	0.075	0.274	2.5	179	73	72
B-1	0.072	0.268	2.4	173	74	73
B-1	0.085	0.292	2.8	185	74	74
B-2	0.080	0.283	2.6	180	75	75
B-2	0.076	0.276	2.5	173	76	76
B-2	0.071	0.266	2.3	179	77	76
B-3	0.081	0.285	2.7	178	78	77
B-3	0.076	0.276	2.5	184	79	78
B-3	0.079	0.281	2.6	185	79	78
C-1	0.084	0.290	2.8	176	79	78
C-1	0.081	0.285	2.7	175	78	78
C-1	0.074	0.272	2.4	181	78	78
C-2	0.076	0.276	2.5	186	78	78
C-2	0.080	0.283	2.6	175	78	78
C-2	0.082	0.286	2.7	181	77	78
C-3	0.078	0.279	2.6	184	76	77
C-3	0.084	0.290	2.8	180	75	75
C-3	0.076	0.276	2.5	181	75	75
D-1	0.076	0.276	2.5	167	73	75
D-1	0.072	0.268	2.4	170	73	74
D-1	0.081	0.285	2.7	175	72	72
D-2	0.081	0.285	2.7	167	72	72
D-2	0.077	0.277	2.5	170	72	72
D-2	0.077	0.277	2.5	170	71	72
D-3	0.080	0.283	2.6	178	71	71
D-3	0.076	0.276	2.5	172	71	71
D-3	0.076	0.276	2.5	178	70	71
Average	0.08	0.2798	2.58	178.4		73.1

Initial volume	617.908	ft^3	Initial volume	0.000	liters
Final volume	783.914	ft^3	Final volume	0.000	liters
Total metered	166.006	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	865.3	370.3	495.0			0.0
2	702.4	689.6	12.8			0.0
3	710.1	704.4	5.7			0.0
4	623.6	619.0	4.6			0.0
5	823.3	774.3	49.0			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	3724.7	3157.6	567.1	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal	Test Date:	Nov. 1, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Quench Tower	Test Start Time:	10:32 AM
Unit Operation:	Normal	Test Finish Time:	10:28 PM

USEPA Method 23 Individual Emission Rates

Compound		Mass (pg)	Mass (µg)	Adjusted TEF Mass (µg)	Raw Concentration (µg/m³)	Raw ER (lb/hr)	TEF Conc. (µg/m³)	TEF Emissions (lb/hr)
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	<	3.4	0.0000034	0.0000034	7.4E-07	N/A	7.4E-07	NA
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	4.3	0.0000043	0.00000215	9.4E-07	N/A	4.7E-07	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.2	0.0000032	0.00000032	7.0E-07	N/A	7.0E-08	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin		11.6	0.0000116	0.00000116	2.5E-06	N/A	2.5E-07	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin		16.5	0.0000165	0.00000165	3.6E-06	N/A	3.6E-07	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		215	0.000215	0.00000215	4.7E-05	N/A	4.7E-07	NA
2,3,7,8-Tetrachlorodibenzofuran		7.2	0.0000072	0.00000072	1.6E-06	N/A	1.6E-07	NA
1,2,3,7,8-Pentachlorodibenzofuran	<	4.4	0.0000044	0.00000022	9.6E-07	N/A	4.8E-08	NA
2,3,4,7,8-Pentachlorodibenzofuran	<	4.4	0.0000044	0.0000022	9.6E-07	N/A	4.8E-07	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	<	4.1	0.0000041	0.00000041	9.0E-07	N/A	9.0E-08	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	<	3.9	0.0000039	0.00000039	8.5E-07	N/A	8.5E-08	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	<	4.3	0.0000043	0.00000043	9.4E-07	N/A	9.4E-08	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	<	4.5	0.0000045	0.00000045	9.8E-07	N/A	9.8E-08	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran		8.3	0.0000083	0.000000083	1.8E-06	N/A	1.8E-08	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.5	0.0000035	0.000000035	7.6E-07	N/A	7.6E-09	NA
								NA

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene		36	0.0079	NA
Acenaphthylene		37	0.0081	NA
Anthracene		27	0.0059	NA
Benz[a]anthracene	<	20	0.0044	NA
Benzo[a]pyrene	<	20	0.0044	NA
Benzo[b]fluoranthene	<	20	0.0044	NA
Benzo[g,h,i]perylene	<	20	0.0044	NA
Benzo[k]fluoranthene	<	20	0.0044	NA
Chrysene	<	20	0.0044	NA
Dibenz[a,h]anthracene	<	20	0.0044	NA
Fluoranthene		59	0.0129	NA
Fluorene		44	0.0096	NA
Indeno (1,2,3-cd) pyrene	<	20	0.0044	NA
Naphthalene		137	0.0299	NA
Phenanthrene		148	0.0323	NA
Perylene	<	15	0.0033	NA
Pyrene		41	0.0090	NA

Client:	ArcelorMittal	Test Date:	Nov. 1-2, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 4
Unit:	Quench Tower	Test Start Time:	11:41 PM
Unit Operation:	Normal	Test Finish Time:	1:03 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:	1936	
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O
Meter Calibration Factor (Yd)	0.998	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.30	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.476	inches
O2	20.69	% dv
CO2	0.11	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Semi-vols 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)	70.3	F
Stack Temperature (Tsavg)	172.4	F
Orifice Pressure Drop (dHavg)	2.406	in. H_2O
GasVelocity Head (dP)^^avg	0.2706	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
Total Test Time	13.37	hours
# of quenches	36	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	79.21	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	647.4	g
Water Vapor in Silica Gel (Vwsg(std))	30.526	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	30.526	scf
Volume Dry Gas Metered (Vm)	159.829	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	156.409	dscf
Volume Dry Gas Metered (Vm(m^3))	4.526	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.429	dscm
Stack Absolute Pressure (Ps)	29.30	in. Hg
Stack Absolute Temperature (Tsavg)	632.1	R
H2O Vapor Pressure @ avg Stack Temp.	12.90	in. Hg
H2O in the gas at saturation (Bws)	0.4403	vol. fraction
H2O in the gas from test data (Bws)	0.1633	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1633	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.07	lb/lb-mole
Gas Velocity (Vs)	17.35	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	936,771	acfm
Standard Gas Flowrate	765,950	scfm
Dry Standard Gas Flowrate	640,871	dscfm
Dry Standard Exhaust Gas Flowrate	2,878.6	1000 lb/hr
Actual Gas Flowrate	26,527	acm/min
Standard Gas Flowrate	21,689	scm/min
Dry Standard Gas Flowrate	18,148	dscm/min
Area Nozzle (An)	0.001236	ft^2
Percent of Isokinetic Sampling (I)	98.80	%

Dioxin Furan

Analyte		TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
2378-TCDD	<	1	4.6	0.0046	0.0046
12378-PeCDD	<	0.5	4.2	0.0042	0.0021
123478-HxCDD	<	0.1	3.9	0.0039	0.00039
123678-HxCDD	<	0.1	3.9	0.0039	0.00039
123789-HxCDD		0.1	5.5	0.0055	0.00055
1234678-HpCDD		0.01	48.3	0.0483	0.000483
2378-TCDF (DB 225)		0.1	30.5	0.0305	0.00305
12378-PeCDF	<	0.05	4.4	0.0044	0.00022
23478-PeCDF	<	0.5	4.4	0.0044	0.0022
123478-HxCDF	<	0.1	3.8	0.0038	0.00038
123678-HxCDF	<	0.1	3.7	0.0037	0.00037
234678-HxCDF	<	0.1	4	0.0040	0.0004
123789-HxCDF	<	0.1	4.2	0.0042	0.00042
1234678-HpCDF		0.01	3.9	0.0039	0.000039
1234789-HpCDF	<	0.01	3.1	0.0031	0.000031

TEF Factors taken from USEPA 40 CFR, Chapter 1, Part 266, Appendix IX, Table 4.0.1 TEF ADJUSTED TOTAL. 0.016

TEF Total Mass Collected	<	0.016	ng
TEF Emission Concentration	<	0.004	ng/m^3
TEF Emission Rate	<	N/A	ng/hr
Emission Rate	<	N/A	gr/hr
Emission Rate	<	N/A	lb/hr

ArcelorMittal Quench Tower **Run 4** **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	0.080	0.283	2.6	165	74	76
A-1	0.081	0.285	2.7	170	74	75
A-1	0.068	0.261	2.2	177	73	74
A-2	0.072	0.268	2.4	167	72	73
A-2	0.075	0.274	2.5	180	72	73
A-2	0.076	0.276	2.5	181	71	72
A-3	0.068	0.261	2.2	181	70	71
A-3	0.080	0.283	2.6	170	71	73
A-3	0.080	0.283	2.6	180	72	73
B-1	0.070	0.265	2.3	176	73	73
B-1	0.068	0.261	2.2	175	73	74
B-1	0.076	0.276	2.5	178	72	73
B-2	0.070	0.265	2.3	168	72	73
B-2	0.070	0.265	2.3	175	70	71
B-2	0.072	0.268	2.4	180	70	71
B-3	0.072	0.268	2.4	173	70	71
B-3	0.080	0.283	2.6	168	70	71
B-3	0.075	0.274	2.5	170	72	72
C-1	0.070	0.265	2.3	170	72	72
C-1	0.068	0.261	2.2	170	72	72
C-1	0.075	0.274	2.5	165	72	72
C-2	0.073	0.270	2.4	172	68	68
C-2	0.074	0.272	2.4	171	67	67
C-2	0.073	0.270	2.4	172	67	68
C-3	0.071	0.266	2.3	169	66	65
C-3	0.074	0.272	2.4	171	65	65
C-3	0.075	0.274	2.5	168	66	66
D-1	0.073	0.270	2.4	172	66	65
D-1	0.070	0.265	2.3	170	66	68
D-1	0.068	0.261	2.2	173	69	66
D-2	0.072	0.268	2.4	175	67	66
D-2	0.075	0.274	2.5	173	68	66
D-2	0.077	0.277	2.5	169	69	67
D-3	0.073	0.270	2.4	169	70	68
D-3	0.072	0.268	2.4	172	72	73
D-3	0.071	0.266	2.3	171	74	70
Average	0.073	0.271	2.41	172.4		70.3

Initial volume	785.057	ft^3	Initial volume	0.000	liters
Final volume	944.886	ft^3	Final volume	0.000	liters
Total metered	159.829	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1199.4	614.6	584.8			0.0
2	678.7	668.0	10.7			0.0
3	702.5	700.1	2.4			0.0
4	352.9	351.0	1.9			0.0
5	822.7	775.1	47.6			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	3756.2	3108.8	647.4	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:	Nov. 1-2, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 4
Unit:	Quench Tower	Test Start Time:	11:41 PM
Unit Operation:	Normal	Test Finish Time:	1:03 PM

USEPA Method 23 Individual Emission Rates

Compound		Mass (pg)	Mass (µg)	Adjusted TEF Mass (µg)	Raw Concentration (µg/m³)	Raw ER (lb/hr)	TEF Conc. (µg/m³)	TEF Emissions (lb/hr)
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	<	4.6	0.0000046	0.0000046	1.0E-06	N/A	1.0E-06	NA
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	4.2	0.0000042	0.0000021	9.5E-07	N/A	4.7E-07	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.9	0.0000039	0.00000039	8.8E-07	N/A	8.8E-08	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	<	3.9	0.0000039	0.00000039	8.8E-07	N/A	8.8E-08	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin		5.5	0.0000055	0.00000055	1.2E-06	N/A	1.2E-07	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		48.3	0.0000483	0.000000483	1.1E-05	N/A	1.1E-07	NA
2,3,7,8-Tetrachlorodibenzofuran		30.5	0.0000305	0.00000305	6.9E-06	N/A	6.9E-07	NA
1,2,3,7,8-Pentachlorodibenzofuran	<	4.4	0.0000044	0.00000022	9.9E-07	N/A	5.0E-08	NA
2,3,4,7,8-Pentachlorodibenzofuran	<	4.4	0.0000044	0.0000022	9.9E-07	N/A	5.0E-07	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	<	3.8	0.0000038	0.00000038	8.6E-07	N/A	8.6E-08	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	<	3.7	0.0000037	0.00000037	8.4E-07	N/A	8.4E-08	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	<	4	0.000004	0.0000004	9.0E-07	N/A	9.0E-08	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	<	4.2	0.0000042	0.00000042	9.5E-07	N/A	9.5E-08	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran		3.9	0.0000039	0.000000039	8.8E-07	N/A	8.8E-09	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.1	0.0000031	0.000000031	7.0E-07	N/A	7.0E-09	NA
								NA

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene		24	0.0054	NA
Acenaphthylene	<	20	0.0045	NA
Anthracene	<	20	0.0045	NA
Benz[a]anthracene	<	20	0.0045	NA
Benzo[a]pyrene	<	20	0.0045	NA
Benzo[b]fluoranthene	<	20	0.0045	NA
Benzo[g,h,i]perylene	<	20	0.0045	NA
Benzo[k]fluoranthene	<	20	0.0045	NA
Chrysene	<	20	0.0045	NA
Dibenz[a,h]anthracene	<	20	0.0045	NA
Fluoranthene		29	0.0065	NA
Fluorene		30	0.0068	NA
Indeno (1,2,3-cd) pyrene	<	20	0.0045	NA
Naphthalene		126	0.0284	NA
Phenanthrene		77	0.0174	NA
Perylene	<	15	0.0034	NA
Pyrene		25	0.0056	NA

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.977	Start Time:	3:29
Date:	10-27-16	Run Number:	1	Meter Correction (γ):	1.006	Stop Time:	16:40
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.476	Pitot Correction:	0.84	T/C ID:	9-2
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	+.01	Control Box ID:	MB: 1724	Probe ID:	9-2
		Baro. Pres. (in. Hg):	29.14	Assumed Moisture (%):	20	Pitot ID:	9-2
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	55°F	Umbilical Length (Feet):	200'	Filter ID:	NA/ Trap #
Test Crew:	BC JW CB TM Indira	Initial K-factor	~~32.8~~ 35.5			Stack Diameter (inches):	600" x 216" RECT

(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
		303.100											
A-1	0:02:30	305.432	0.080	2.84	10	165	257	253	55	53	67	67	
A-1	0:05:00	307.692	0.080	2.8	10	159	258	256	50	52	66	67	
A-1	0:07:30	310.106	0.081	2.8	10	158	258	254	50	53	66	67	3:44
A-2	0:10:00	312.297	0.075	2.7	10	160	258	254	50	50	66	67	4:03
A-2	0:12:30	315.063	0.075	2.7	10	171	257	254	49	50	66	66	
A-2	0:15:00	317.015	0.072	2.6	10	170	256	254	49	50	66	66	4:12
A-3	0:17:30	319.623	0.075	2.7	10	168	256	254	49	50	67	67	
A-3	0:20:00	321.483	0.075	2.7	10	168	250	254	50	50	67	67	4:34
A-3	0:22:30	323.692	0.075	2.7	10	168	251	253	50	49	66	67	4:46
A-4	0:25:00	326.128	0.080	2.8	10	168	251	254	48	50	67	67	4:52
A-4	0:27:30	328.150	0.080	2.8	10	170	250	254	49	49	67	67	
A-4	0:30:00	330.210	0.072	2.6	11	172	259	254	50	51	66	66	5:02
A-5	0:32:30	332.816	0.080	2.8	11	170	258	256	50	49	68	69	5:24
A-5	0:35:00	335.306	0.080	2.8	11	159	258	254	50	49	68	69	
A-5	0:37:30	338.252	0.072	2.6	11	168	247	254	49	49	69	70	5:56
A-6	0:40:00	339.512	0.072	2.6	11	170	247	254	49	49	69	70	6:05
A-6	0:42:30	341.630	0.068	2.4	10	169	254	254	49	48	70	70	6:21
A-6	0:45:00	342.938	0.068	2.4	10	180	249	254	50	49	70	70	
B-1	0:47:30	344.528	0.068	2.4	10	183	249	254	50	49	70	70	6:33
B-1	0:50:00	346.625	0.080	2.8	11	185	248	254	52	48	70	74	
B-1	0:52:30	348.900	0.080	2.8	11	180	249	254	52	50	71	76	6:50
B-2	0:55:00	351.202	0.080	2.8	11	182	249	254	52	50	71	77	
B-2	0:57:30	353.48	.074	2.6	12	174	245	253	54	55	77	75	
B-2	1:00:00	356.32	.078	2.8	12	178	239	254	55	56	77	75	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	18	0.003
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

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

Fyrite Kit ID: NA Fyrite O_2 Check NA %

Balance ID: BAL 017

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)	936.4	348.4	
2	H_2O (g)	691.0	687.4	
3	H_2O (g)	705.8	704.4	
4	Empty (g)	621.3	618.4	
5	Silica (g)	822.5	777.7	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 10/26/16- 10/27/16 **Run Number:** 1 **Sampling Location:** Quench Tower Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
B-3	1:02:30	358.01	.081	2.9	13	185	241	244	64	57	77	75	
B-3	1:05:00	360.28	.079	2.8	13	185	246	249	65	58	76	75	
B-3	1:07:30	362.66	.085	3.0	13	179	251	254	64	58	76	75	
B-4	1:10:00	365.07	.072	2.6	11	183	252	253	62	50	76	75	
B-4	1:12:30	367.46	.080	2.8	13	177	245	254	56	51	76	75	
B-4	1:15:00	369.76	.085	3.0	13	181	251	254	54	50	76	75	
B-5	1:17:30	371.82	.071	2.5	11	184	253	255	54	54	76	75	
B-5	1:20:00	374.44	.084	3.0	13	178	242	256	54	51	76	75	
B-5	1:22:30	376.90	.083	2.9	13	180	244	248	56	53	77	75	
B-6	1:25:00	379.22	.077	2.7	12	175	249	254	58	55	78	76	
B-6	1:27:30	381.70	.084	3.0	13	182	247	250	60	57	78	76	
B-6	1:30:00	383.88	.080	2.8	12	178	244	245	61	58	79	76	
C-1	1:32:30	386.49	.072	2.6	12	172	249	252	61	55	79	76	
C-1	1:35:00	388.56	.074	2.6	12	179	251	252	62	59	80	77	
C-1	1:37:30	390.86	.081	2.9	13	183	252	255	62	60	81	78	
C-2	1:40:00	393.27	.082	2.9	13	178	252	250	62	61	81	78	
C-2	1:42:30	395.64	.075	2.7	12	174	250	256	63	61	81	79	
C-2	1:45:00	397.94	.079	2.8	12	180	250	247	63	60	81	79	
C-3	1:47:30	400.35	.084	3.0	13	175	241	248	61	58	82	80	
C-3	1:50:00	402.78	.072	2.6	11	172	244	250	58	58	84	81	
C-3	1:52:30	404.52	.080	2.8	12	179	242	249	57	53	84	81	
C-4	1:55:00	407.38	.080	2.8	12	184	248	254	56	50	85	82	12:31
C-4	1:57:30	409.77	.076	2.7	12	180	245	245	52	55	79	79	
C-4	2:00:00	412.08	.073	2.6	11	186	250	252	55	52	79	78	
C-5	2:02:30	413.46	.070	2.5	11	174	240	251	58	58	79	78	12:43
C-5	2:05:00	416.48	.078	2.8	12	173	249	249	57	55	79	78	12:58
C-5	2:07:30	418.91	.069	2.4	11	182	241	249	58	58	80	78	
C-6	2:10:00	420.96	.077	2.7	12	186	255	253	58	56	80	78	13:11
C-6	2:12:30	423.41	.077	2.7	12	189	246	251	60	63	80	79	13:24
C-6	2:15:00	425.69	.081	2.9	13	180	241	246	63	65	80	78	
D-1	2:17:30	426.00	.077	2.7	12	174	242	250	61	57	80	79	13:36
D-1	2:20:00	430.33	.073	2.6	11	182	248	250	61	58	80	78	
D-1	2:22:30	432.48	.069	2.4	11	177	250	249	62	64	80	79	13:48
D-2	2:25:00	434.82	.078	2.8	12	180	239	254	62	59	80	78	13:58
D-2	2:27:30	437.11	.072	2.6	11	179	235	251	62	63	80	79	
D-2	2:30:00	438.96	.080	2.8	12	184	240	257	63	61	80	79	14:11
D-3	2:32:30	~~246.2~~ 441.72	.077	2.7	12	185	250	256	64	65	80	79	14:55
D-3	2:35:00	444.08	.075	2.7	12	180	241	253	56	53	80	78	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 10/26/16 - 10/27/16 **Run Number:** 1 **Sampling Location:** Quench Tower Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
D-3	2:37:30	446.17	.070	2.5	11	172	245	252	60	57	80	79	15:30
D-4	2:40:00	448.58	.078	2.8	12	182	243	251	60	55	80	79	
D-4	2:42:30	450.94	.084	3.0	13	185	237	252	62	61	80	78	15:44
D-4	2:45:00	453.29	.079	2.8	12	179	246	253	62	60	80	78	15:56
D-5	2:47:30	455.72	.077	2.7	12	181	236	246	64	60	80	79	
D-5	2:50:00	457.93	.084	3.0	13	178	247	253	60	57	80	79	16:09
D-5	2:52:30	460.27	.081	2.9	13	175	246	248	64	55	81	79	16:23
D-6	2:55:00	462.41	.073	2.6	11	184	242	250	63	53	82	79	
D-6	2:57:30	464.61	.080	2.8	12	179	244	250	57	53	81	79	16:36
D-6	3:00:00	467.021	.077	2.7	12	181	239	248	57	49	81	79	16:40

ArcelorMittal Monessen Quench Tower IGR Test Report 16-167 Page 131 of 537

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.830	Start Time:	10:32
Date:	11-1-16	Run Number:	3	Meter Correction (γ):	0.998	Stop Time:	22:28
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.476	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	0.01	Control Box ID:	MB 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.30	Assumed Moisture (%):	20	Pitot ID:	9-6
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	62	Umbilical Length (Feet):	200'	Filter ID:	NA/ Trap # 2
Test Crew:	BC JW CB TM	Initial K-factor	32.8			Stack Diameter (inches):	600 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 617.908	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	0:05:00	622.51	.078	2.6	11	179	239	249	49	51	66	66	10:46
A-1	0:10:00	626.93	.075	2.5	11	183	256	248	54	54	65	66	11:01
A-1	0:15:00	631.55	.081	2.7	12	175	249	248	58	56	65	66	11:16
A-2	0:20:00	636.029	.076	2.5	12	179	241	247	56	59	67	67	12:00
A-2	0:25:00	640.68	.083	2.7	12	188	251	248	53	56	67	67	12:24
A-2	0:30:00	645.37	.081	2.7	12	186	242	248	56	58	68	68	12:39
A-3	0:35:00	649.82	.077	2.5	12	179	248	247	62	63	70	68	12:53
A-3	0:40:00	654.397	.080	2.6	12	181	245	248	60	64	70	69	13:07
A-3	0:45:00	659.06	.082	2.7	12	189	243	248	59	64	72	71	13:29
B-1	0:50:00	663.56	.075	2.5	12	179	250	248	60	65	73	72	13:43
B-1	0:55:00	668.01	.072	2.4	11	173	248	247	62	67	74	73	14:18
B-1	1:00:00	672.768	.085	2.8	12	185	247	248	59	63	74	74	14:31
B-2	1:05:00	677.36	.080	2.6	12	180	239	248	57	62	75	75	14:54
B-2	1:10:00	681.86	.076	2.5	12	173	247	248	57	63	76	76	15:07
B-2	1:15:00	686.30	.071	2.3	11	179	251	247	58	65	77	76	15:21
B-3	1:20:00	690.993	.081	2.7	12	178	251	248	57	63	78	77	15:40
B-3	1:25:00	695.59	.076	2.5	12	184	244	249	59	66	79	78	16:03 RLO 11-1-16
B-3	1:30:00	700.11	.079	2.6	12	185	249	247	60	66	79	78	~~16:11~~ 16:50
C-1	1:35:00	704.87	.084	2.8	12	176	253	247	58	63	79	78	17:02
C-1	1:40:00	709.619	.081	2.7	12	175	247	247	60	64	78	78	17:18
C-1	1:45:00	714.03	.074	2.4	11	181	255	248	63	67	78	78	17:39
C-2	1:50:00	718.51	.076	2.5	12	186	241	248	62	65	78	78	17:52
C-2	1:55:00	723.10	.080	2.6	12	175	249	248	62	66	78	78	18:06
C-2	2:00:00	727.587	.082	2.7	12	181	253	248	61	64	77	78	18:20

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min) RLO 11-1-16
Train Leak	Initial	20	~~0.005~~ 0.016
Check	Final	10	0.002
		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: BAL-017

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

Reference Weight (500g): 5000 Tolerance = +/- 0.5 g

Imp	Contents	Final	Initial	Difference
1	Empty (g)	665.3	370.3	
2	H_2O (g)	702.4	689.6	
3	H_2O (g)	710.1	704.4	
4	Empty (g)	623.6	619.0	
5	Silica (g)	823.3	774.3	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 11-1-16 **Run Number:** 3 **Sampling Location:** Quench Tower Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	2:05:00	732.051	.078	2.6	12	184	247	248	62	66	76	77	19:12
C-3	2:10:00	736.987	0.084	2.8	12	180	247	248	62	63	75	75	19:25
C-3	2:15:00	741.533	0.076	2.5	12	181	248	248	55	57	75	75	19:38
D-1	2:20:00	746.288	0.076	2.5	12	167	248	248	56	58	73	75	19:52
D-1	2:25:00	751.489	0.072	2.4	12	170	248	248	55	57	73	74	20:05
D-1	2:30:00	756.050	0.081	2.7	12	175	248	248	56	58	72	72	20:18
D-2	2:35:00	760.823	0.081	2.7	12	167	247	248	55	56	72	72	20:30
D-2	2:40:00	765.452	0.077	2.9	12	170	248	248	54	56	72	72	20:43
D-2	2:45:00	770.095	0.077	2.5	12	170	248	248	53	57	71	72	21:05 21:41
D-3	2:50:00	774.632	0.080	2.6	12	178	243	248	56	58	71	71	22:06
D-3	2:55:00	779.347	0.076	2.5	12	172	248	248	56	57	71	71	22:16
D-3	3:00:00	783.914	0.076	2.5	12	178	248	248	54	55	70	71	22:26

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.830	Start Time:	23:41
Date:	11-01-16	Run Number:	4	Meter Correction (γ):	0.998	Stop Time:	13:03
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.476	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	.01	Control Box ID:	MB: 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.30	Assumed Moisture (%):	20	Pitot ID:	9-6
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	62	Umbilical Length (Feet):	200'	Filter ID:	NA/ Trap #
Test Crew:	BC JW CB TM BTP	Initial K-factor	32.8			Stack Diameter (inches):	600 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 785.057	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	0:05:00	789.924	0.080	2.6	12	165	246	248	54	59	74	76	23:41
A-1	0:10:00	794.090	0.081	2.7	12	170	248	248	53	55	74	75	23:57
A-1	0:15:00	798.370	0.068	2.2	12	177	248	248	55	57	73	74	0:04
A-2	0:20:00	803.618	0.072	2.4	12	167	248	248	56	58	72	73	0:40
A-2	0:25:00	807.183	0.075	2.5	12	180	248	248	56	56	72	73	0:53
A-2	0:30:00	810.963	0.076	2.5	12	181	248	248	55	56	71	72	2:28 Plant issues
A-3	0:35:00	815.817	0.68	2.2	12	181	248	248	54	55	70	71	2:44 3:01
A-3	0:40:00	820.124	0.080	2.6	12	170	246	249	51	62	71	73	3:08
A-3	0:45:00	824.678	0.080	2.6	12	180	241	248	58	62	72	73	3:22
B-1	0:50:00	829.157	0.070	2.3	12	176	248	248	57	63	73	73	3:32
B-1	0:55:00	833.665	0.068	2.2	12	175	248	248	60	63	73	74	3:42 4:18
B-1	1:00:00	838.306	0.076	2.5	12	178	248	248	50	51	72	73	4:29
B-2	1:05:00	842.569	0.070	2.3	12	168	248	248	49	54	72	73	4:40
B-2	1:10:00	846.997	0.070	2.3	12	175	246	248	47	52	70	71	4:50
B-2	1:15:00	851.611	0.072	2.4	12	180	244	248	47	53	70	71	5:00 5:16
B-3	1:20:00	856.318	0.072	2.4	12	173	248	248	48	56	70	71	5:28
B-3	1:25:00	860.670	0.080	2.6	12	168	251	248	48	56	70	71	5:43
B-3	1:30:00	865.000	0.075	2.5	12	170	252	248	51	56	72	72	5:55
C-1	1:35:00	869.365	0.070	2.3	12	170	255	248	51	57	72	72	6:08
C-1	1:40:00	873.785	0.068	2.2	12	170	250	248	51	57	72	72	6:25 6:37
C-1	1:45:00	878.328	0.075	2.5	12	165	250	248	51	57	72	72	6:49
C-2	1:50:00	882.693	0.073	2.4	12	172	246	248	55	59	68	68	7:41
C-2	1:55:00	887.038	0.074	2.4	12	171	240	248	53	56	67	67	7:55
C-2	2:00:00	891.505	0.073	2.4	12	172	249	247	51	54	67	68	8:09

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	17	0.000
Check	Final	16	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: CAL-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)	1199.4	614.6	
2	H_2O (g)	678.7	668.0	
3	H_2O (g)	702.5	700.0	
4	Empty (g)	352.9	351.0	
5	Silica (g)	822.7	775.1	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 11/1/16 **Run Number:** 4 **Sampling Location:** Quench Tower Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	2:05:00	895.898	0.071	2.3	12	169	245	248	47	52	66	65	~~8:23~~ 9:06
C-3	2:10:00	900.285	0.074	2.4	12	171	258	248	51	52	65	65	9:37
C-3	2:15:00	904.750	0.075	2.5	12	168	247	247	52	54	66	66	9:52
D-1	2:20:00	909.290	0.073	2.4	12	172	248	248	54	56	66	65	10:04
D-1	2:25:00	913.787	0.070	2.3	12	170	242	249	55	57	66	68	10:17
D-1	2:30:00	917.965	0.068	2.2	12	173	249	248	56	58	69	66	10:30
D-2	2:35:00	922.335	0.072	2.4	12	175	245	248	60	62	67	66	10:41
D-2	2:40:00	926.674	0.075	2.5	12	173	254	248	62	63	68	66	~~10:55~~ 10:55
D-2	2:45:00	931.046	0.077	2.5	13	169	245	248	63	65	69	67	12:06
D-3	2:50:00	935.825	0.073	2.4	13	169	245	249	63	65	70	68	12:20
D-3	2:55:00	940.272	0.072	2.4	13	172	240	247	63	66	72	73	12:39
D-3	3:00:00	944.886	0.071	2.3	13	171	244	248	60	62	74	70	12:46

Method 315

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/27	03:30:01	21.04	0.01
2	2016/10/27	03:31:01	21.04	0.03
3	2016/10/27	03:32:01	20.82	0.03
4	2016/10/27	03:33:01	21.01	0.01
5	2016/10/27	03:43:01	21.05	0.02
6	2016/10/27	03:44:01	20.68	0.00
7	2016/10/27	03:45:01	21.05	0.03
8	2016/10/27	03:46:01	21.05	0.03
9	2016/10/27	04:14:01	21.07	0.02
10	2016/10/27	04:15:01	20.79	0.04
11	2016/10/27	04:16:01	21.05	0.01
12	2016/10/27	04:17:01	21.06	0.01
13	2016/10/27	04:26:01	21.06	0.03
14	2016/10/27	04:27:01	20.73	0.02
15	2016/10/27	04:28:01	21.06	0.01
16	2016/10/27	04:29:01	21.07	0.03
17	2016/10/27	04:39:01	21.08	0.01
18	2016/10/27	04:40:01	20.83	0.04
19	2016/10/27	04:41:01	21.06	0.03
20	2016/10/27	04:42:01	21.08	0.00
21	2016/10/27	04:52:01	21.08	0.02
22	2016/10/27	04:53:01	20.83	0.00
23	2016/10/27	04:54:01	21.05	0.03
24	2016/10/27	04:55:01	21.08	0.03
25	2016/10/27	05:05:01	21.07	0.02
26	2016/10/27	05:06:01	20.97	0.04
27	2016/10/27	05:07:01	20.98	0.02
28	2016/10/27	05:08:01	21.07	0.01
29	2016/10/27	05:24:01	21.06	0.04
30	2016/10/27	05:25:01	20.93	0.02
31	2016/10/27	05:26:01	21.06	0.01
32	2016/10/27	05:27:01	21.06	0.03
33	2016/10/27	05:57:01	21.07	0.03
34	2016/10/27	05:58:01	20.94	0.01
35	2016/10/27	05:59:01	21.07	0.01
36	2016/10/27	06:00:01	21.07	0.03
37	2016/10/27	06:09:01	21.06	0.01
38	2016/10/27	06:10:01	20.98	0.03
39	2016/10/27	06:11:01	21.07	0.03
40	2016/10/27	06:12:01	21.08	0.02
41	2016/10/27	06:24:01	21.06	0.00
42	2016/10/27	06:25:01	20.91	0.03
43	2016/10/27	06:26:01	21.06	0.03
44	2016/10/27	06:27:01	21.07	0.01
45	2016/10/27	07:15:01	19.71	0.00
46	2016/10/27	07:16:01	19.55	0.02
47	2016/10/27	07:17:01	19.71	0.05
48	2016/10/27	07:18:01	19.72	0.02
49	2016/10/27	07:38:01	19.70	0.03
50	2016/10/27	07:39:01	19.60	0.04
51	2016/10/27	07:40:01	19.70	0.01
52	2016/10/27	07:41:01	19.70	0.01
53	2016/10/27	07:50:01	19.68	0.04

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
54	2016/10/27	07:51:01	19.23	0.01
55	2016/10/27	07:52:01	19.67	0.05
56	2016/10/27	07:53:01	19.70	0.04
57	2016/10/27	08:04:01	19.69	0.03
58	2016/10/27	08:05:01	19.64	0.04
59	2016/10/27	08:06:01	19.70	0.01
60	2016/10/27	08:07:01	19.67	0.03
61	2016/10/27	08:18:01	19.70	0.03
62	2016/10/27	08:19:01	19.50	0.03
63	2016/10/27	08:20:01	19.70	0.01
64	2016/10/27	08:21:01	19.71	0.01
65	2016/10/27	08:32:01	19.71	0.02
66	2016/10/27	08:33:01	19.49	0.03
67	2016/10/27	08:34:01	19.73	0.01
68	2016/10/27	08:35:01	19.71	0.01
69	2016/10/27	08:48:01	19.71	0.03
70	2016/10/27	08:49:01	19.31	0.01
71	2016/10/27	08:50:01	19.69	0.02
72	2016/10/27	08:51:01	19.71	0.04
73	2016/10/27	09:35:01	19.69	0.04
74	2016/10/27	09:36:01	19.62	0.03
75	2016/10/27	09:37:01	19.69	0.01
76	2016/10/27	09:38:01	19.68	0.04
77	2016/10/27	09:47:01	19.68	0.02
78	2016/10/27	09:48:01	19.53	0.02
79	2016/10/27	09:49:01	19.68	0.04
80	2016/10/27	09:50:01	19.69	0.03
81	2016/10/27	09:58:01	19.67	0.01
82	2016/10/27	09:59:01	19.44	0.02
83	2016/10/27	10:00:01	19.68	0.05
84	2016/10/27	10:01:01	19.67	0.02
85	2016/10/27	10:11:01	19.65	0.04
86	2016/10/27	10:12:01	19.43	0.02
87	2016/10/27	10:13:01	19.67	0.03
88	2016/10/27	10:14:01	19.66	0.03
89	2016/10/27	10:36:01	19.62	0.04
90	2016/10/27	10:37:01	19.37	0.04
91	2016/10/27	10:38:01	19.63	0.02
92	2016/10/27	10:39:01	19.63	0.02
93	2016/10/27	10:52:01	19.60	0.02
94	2016/10/27	10:53:01	19.35	0.01
95	2016/10/27	10:54:01	19.59	0.04
96	2016/10/27	10:55:01	19.62	0.04
97	2016/10/27	11:07:01	19.61	0.01
98	2016/10/27	11:08:01	19.44	0.02
99	2016/10/27	11:09:01	19.61	0.04
100	2016/10/27	11:10:01	19.61	0.02
101	2016/10/27	11:20:01	19.61	0.04
102	2016/10/27	11:21:01	19.46	0.02
103	2016/10/27	11:22:01	19.59	0.02
104	2016/10/27	11:23:01	19.59	0.04
105	2016/10/27	12:13:01	19.60	0.02
106	2016/10/27	12:14:01	19.57	0.04
107	2016/10/27	12:15:01	19.63	0.02
108	2016/10/27	12:16:01	19.63	0.01
109	2016/10/27	12:35:01	19.64	0.03
110	2016/10/27	12:36:01	19.57	0.03
111	2016/10/27	12:37:01	19.61	0.03
112	2016/10/27	12:38:01	19.64	0.01
113	2016/10/27	12:47:01	19.64	0.04
114	2016/10/27	12:48:01	19.53	0.02
115	2016/10/27	12:49:01	19.66	0.02
116	2016/10/27	12:50:01	19.65	0.04

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
117	2016/10/27	12:59:01	19.65	0.01
118	2016/10/27	13:00:01	19.21	0.02
119	2016/10/27	13:01:01	19.64	0.08
120	2016/10/27	13:02:01	19.66	0.02
121	2016/10/27	13:14:01	19.66	0.01
122	2016/10/27	13:15:01	19.29	0.03
123	2016/10/27	13:16:01	19.63	0.05
124	2016/10/27	13:17:01	19.67	0.01
125	2016/10/27	13:27:01	19.67	0.04
126	2016/10/27	13:28:01	19.30	0.01
127	2016/10/27	13:29:01	19.65	0.02
128	2016/10/27	13:30:01	19.67	0.04
129	2016/10/27	13:51:01	19.66	0.03
130	2016/10/27	13:52:01	19.24	0.04
131	2016/10/27	13:53:01	19.66	0.03
132	2016/10/27	13:54:01	19.66	0.01
133	2016/10/27	14:01:01	19.66	0.01
134	2016/10/27	14:02:01	19.36	0.03
135	2016/10/27	14:03:01	19.63	0.06
136	2016/10/27	14:04:01	19.66	0.02
137	2016/10/27	14:14:01	19.67	0.04
138	2016/10/27	14:15:01	19.57	0.01
139	2016/10/27	14:16:01	19.64	0.02
140	2016/10/27	14:17:01	19.66	0.04
141	2016/10/27	14:48:01	19.66	0.01
142	2016/10/27	14:49:01	19.59	0.03
143	2016/10/27	14:50:01	19.67	0.04
144	2016/10/27	14:51:01	19.68	0.02
145	2016/10/27	14:59:01	19.66	0.01
146	2016/10/27	15:00:01	19.39	0.03
147	2016/10/27	15:01:01	19.64	0.04
148	2016/10/27	15:02:01	19.67	0.02
149	2016/10/27	15:33:01	19.67	0.04
150	2016/10/27	15:34:01	19.27	0.03
151	2016/10/27	15:35:01	19.65	0.03
152	2016/10/27	15:36:01	19.68	0.02
153	2016/10/27	15:47:01	19.68	0.03
154	2016/10/27	15:48:01	19.39	0.05
155	2016/10/27	15:49:01	19.68	0.03
156	2016/10/27	15:50:01	19.69	0.01
157	2016/10/27	15:59:01	19.70	0.04
158	2016/10/27	16:00:01	19.34	0.01
159	2016/10/27	16:01:01	19.68	0.04
160	2016/10/27	16:02:01	19.70	0.04
161	2016/10/27	16:13:01	19.70	0.04
162	2016/10/27	16:14:01	19.49	0.03
163	2016/10/27	16:15:01	19.69	0.02
164	2016/10/27	16:16:01	19.69	0.03
165	2016/10/27	16:26:01	19.71	0.01
166	2016/10/27	16:27:01	19.53	0.04
167	2016/10/27	16:28:01	19.63	0.04
168	2016/10/27	16:29:01	19.70	0.01
169	2016/10/27	16:39:01	19.69	0.03
170	2016/10/27	16:40:01	19.35	0.01
171	2016/10/27	16:41:01	19.66	0.03
172	2016/10/27	16:42:01	19.70	0.04
173	2016/10/27	16:54:01	19.72	0.02
174	2016/10/27	16:55:01	19.54	0.01
175	2016/10/27	16:56:01	19.72	0.04
176	2016/10/27	16:57:01	19.74	0.04
177	2016/10/27	17:07:01	19.75	0.04
178	2016/10/27	17:08:01	19.58	0.03
179	2016/10/27	17:09:01	19.70	0.02

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
180	2016/10/27	17:10:01	19.75	0.02
RUN 1 AVERAGES			**20.0**	**0.0**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	
RUN 3					
1	2016/11/01	10:32:01	20.62	0.16	
2	2016/11/01	10:33:01	20.49	0.29	
3	2016/11/01	10:34:01	20.47	0.28	
4	2016/11/01	10:35:01	20.60	0.17	
5	2016/11/01	10:43:01	20.62	0.17	
6	2016/11/01	10:44:01	20.52	0.18	
7	2016/11/01	10:45:01	20.65	0.19	
8	2016/11/01	10:46:01	20.65	0.20	
9	2016/11/01	11:02:01	Calibrations	being	performed
10	2016/11/01	11:03:01	Calibrations	being	performed
11	2016/11/01	11:04:01	Calibrations	being	performed
12	2016/11/01	11:05:01	Calibrations	being	performed
13	2016/11/01	11:13:01	20.48	0.17	
14	2016/11/01	11:14:01	20.30	0.31	
15	2016/11/01	11:15:01	20.40	0.18	
16	2016/11/01	11:16:01	20.45	0.17	
17	2016/11/01	11:56:01	20.81	0.16	
18	2016/11/01	11:57:01	20.66	0.30	
19	2016/11/01	11:58:01	20.66	0.24	
20	2016/11/01	11:59:01	20.75	0.17	
21	2016/11/01	12:10:01	20.84	0.16	
22	2016/11/01	12:11:01	20.74	0.26	
23	2016/11/01	12:12:01	20.68	0.26	
24	2016/11/01	12:13:01	20.77	0.17	
25	2016/11/01	12:23:01	20.83	0.16	
26	2016/11/01	12:24:01	20.60	0.36	
27	2016/11/01	12:25:01	20.74	0.19	
28	2016/11/01	12:26:01	20.77	0.16	
29	2016/11/01	12:37:01	20.83	0.16	
30	2016/11/01	12:38:01	20.58	0.37	
31	2016/11/01	12:39:01	20.76	0.18	
32	2016/11/01	12:40:01	20.79	0.16	
33	2016/11/01	12:50:01	20.82	0.16	
34	2016/11/01	12:51:01	20.72	0.23	
35	2016/11/01	12:52:01	20.64	0.29	
36	2016/11/01	12:53:01	20.77	0.16	
37	2016/11/01	13:06:01	Calibrations	being	performed
38	2016/11/01	13:07:01	Calibrations	being	performed
39	2016/11/01	13:08:01	Calibrations	being	performed
40	2016/11/01	13:09:01	Calibrations	being	performed
41	2016/11/01	13:15:01	20.86	0.16	
42	2016/11/01	13:16:01	20.69	0.32	
43	2016/11/01	13:17:01	20.62	0.34	
44	2016/11/01	13:18:01	20.83	0.16	
45	2016/11/01	13:28:01	20.87	0.16	
46	2016/11/01	13:29:01	20.72	0.30	
47	2016/11/01	13:30:01	20.73	0.25	
48	2016/11/01	13:31:01	20.83	0.16	
49	2016/11/01	13:43:01	20.45	0.42	
50	2016/11/01	13:44:01	20.75	0.17	
51	2016/11/01	13:45:01	20.79	0.16	
52	2016/11/01	13:46:01	20.81	0.16	
53	2016/11/01	14:15:01	20.87	0.15	
54	2016/11/01	14:16:01	20.82	0.20	
55	2016/11/01	14:17:01	20.57	0.40	
56	2016/11/01	14:18:01	20.79	0.17	
57	2016/11/01	14:28:01	20.85	0.16	
58	2016/11/01	14:29:01	20.60	0.37	
59	2016/11/01	14:30:01	20.81	0.16	
60	2016/11/01	14:31:01	20.84	0.15	
61	2016/11/01	14:41:01	20.86	0.15	
62	2016/11/01	14:42:01	20.58	0.41	

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/11/01	14:43:01	20.77	0.19
64	2016/11/01	14:44:01	20.84	0.15
65	2016/11/01	14:54:01	20.86	0.16
66	2016/11/01	14:55:01	20.64	0.33
67	2016/11/01	14:56:01	20.82	0.16
68	2016/11/01	14:57:01	20.84	0.15
69	2016/11/01	15:05:01	20.86	0.15
70	2016/11/01	15:06:01	20.65	0.36
71	2016/11/01	15:07:01	20.69	0.26
72	2016/11/01	15:08:01	20.81	0.15
73	2016/11/01	15:18:01	20.87	0.15
74	2016/11/01	15:19:01	20.76	0.24
75	2016/11/01	15:20:01	20.74	0.23
76	2016/11/01	15:21:01	20.83	0.15
77	2016/11/01	15:36:01	20.86	0.15
78	2016/11/01	15:37:01	20.69	0.32
79	2016/11/01	15:38:01	20.75	0.21
80	2016/11/01	15:39:01	20.83	0.15
81	2016/11/01	15:50:01	20.86	0.14
82	2016/11/01	15:51:01	20.61	0.36
83	2016/11/01	15:52:01	20.80	0.16
84	2016/11/01	15:53:01	20.83	0.15
85	2016/11/01	16:02:01	20.81	0.14
86	2016/11/01	16:03:01	20.58	0.36
87	2016/11/01	16:04:01	20.74	0.19
88	2016/11/01	16:05:01	20.80	0.14
89	2016/11/01	16:48:01	20.88	0.14
90	2016/11/01	16:49:01	20.63	0.35
91	2016/11/01	16:50:01	20.81	0.16
92	2016/11/01	16:51:01	20.82	0.15
93	2016/11/01	16:59:01	20.85	0.15
94	2016/11/01	17:00:01	20.69	0.29
95	2016/11/01	17:01:01	20.75	0.19
96	2016/11/01	17:02:01	20.82	0.15
97	2016/11/01	17:14:01	20.87	0.15
98	2016/11/01	17:15:01	20.62	0.36
99	2016/11/01	17:16:01	20.81	0.16
100	2016/11/01	17:17:01	20.83	0.15
101	2016/11/01	17:26:01	20.87	0.15
102	2016/11/01	17:27:01	20.65	0.33
103	2016/11/01	17:28:01	20.80	0.17
104	2016/11/01	17:29:01	20.84	0.15
105	2016/11/01	17:39:01	20.85	0.16
106	2016/11/01	17:40:01	20.66	0.29
107	2016/11/01	17:41:01	20.82	0.16
108	2016/11/01	17:42:01	20.84	0.15
109	2016/11/01	17:52:01	20.60	0.28
110	2016/11/01	17:53:01	20.77	0.18
111	2016/11/01	17:54:01	20.80	0.17
112	2016/11/01	17:55:01	20.81	0.16
113	2016/11/01	18:04:01	20.86	0.16
114	2016/11/01	18:05:01	20.64	0.34
115	2016/11/01	18:06:01	20.80	0.17
116	2016/11/01	18:07:01	20.84	0.16
117	2016/11/01	18:16:01	20.87	0.16
118	2016/11/01	18:17:01	20.76	0.27
119	2016/11/01	18:18:01	20.73	0.25
120	2016/11/01	18:19:01	20.82	0.16
121	2016/11/01	18:30:01	20.88	0.16
122	2016/11/01	18:31:01	20.71	0.29
123	2016/11/01	18:32:01	20.83	0.17
124	2016/11/01	18:33:01	20.86	0.16
125	2016/11/01	19:12:01	20.91	0.16

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/11/01	19:13:01	20.85	0.22
127	2016/11/01	19:14:01	20.75	0.26
128	2016/11/01	19:15:01	20.84	0.17
129	2016/11/01	19:25:01	20.90	0.17
130	2016/11/01	19:26:01	20.71	0.33
131	2016/11/01	19:27:01	20.82	0.18
132	2016/11/01	19:28:01	20.87	0.17
133	2016/11/01	19:38:01	20.90	0.17
134	2016/11/01	19:39:01	20.75	0.31
135	2016/11/01	19:40:01	20.82	0.20
136	2016/11/01	19:41:01	20.87	0.17
137	2016/11/01	19:53:01	20.90	0.17
138	2016/11/01	19:54:01	20.75	0.31
139	2016/11/01	19:55:01	20.82	0.19
140	2016/11/01	19:56:01	20.87	0.17
141	2016/11/01	20:05:01	20.91	0.17
142	2016/11/01	20:06:01	20.72	0.32
143	2016/11/01	20:07:01	20.84	0.18
144	2016/11/01	20:08:01	20.86	0.17
145	2016/11/01	20:18:01	20.91	0.17
146	2016/11/01	20:19:01	20.73	0.32
147	2016/11/01	20:20:01	20.85	0.18
148	2016/11/01	20:21:01	20.88	0.17
149	2016/11/01	20:30:01	20.91	0.17
150	2016/11/01	20:31:01	20.73	0.31
151	2016/11/01	20:32:01	20.83	0.19
152	2016/11/01	20:33:01	20.87	0.17
153	2016/11/01	20:43:01	20.91	0.17
154	2016/11/01	20:44:01	20.79	0.26
155	2016/11/01	20:45:01	20.80	0.21
156	2016/11/01	20:46:01	20.87	0.17
157	2016/11/01	21:04:01	20.92	0.17
158	2016/11/01	21:05:01	20.79	0.30
159	2016/11/01	21:06:01	20.82	0.23
160	2016/11/01	21:07:01	20.87	0.18
161	2016/11/01	21:41:01	20.89	0.16
162	2016/11/01	21:42:01	20.87	0.18
163	2016/11/01	21:43:01	20.74	0.27
164	2016/11/01	21:44:01	20.84	0.16
165	2016/11/01	21:55:01	20.89	0.15
166	2016/11/01	21:56:01	20.69	0.33
167	2016/11/01	21:57:01	20.83	0.16
168	2016/11/01	21:58:01	20.87	0.15
169	2016/11/01	22:05:01	20.89	0.15
170	2016/11/01	22:06:01	20.75	0.29
171	2016/11/01	22:07:01	20.80	0.19
172	2016/11/01	22:08:01	20.85	0.15
173	2016/11/01	22:16:01	20.88	0.15
174	2016/11/01	22:17:01	20.71	0.30
175	2016/11/01	22:18:01	20.82	0.17
176	2016/11/01	22:19:01	20.85	0.15
177	2016/11/01	22:28:01	20.88	0.13
178	2016/11/01	22:29:01	20.73	0.27
179	2016/11/01	22:30:01	20.81	0.16
180	2016/11/01	22:31:01	20.84	0.13
RUN 3 AVERAGES			**20.8**	**0.2**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 4				
1	2016/11/01	23:42:01	20.68	0.36
2	2016/11/01	23:43:01	20.83	0.18
3	2016/11/01	23:44:01	20.85	0.16
4	2016/11/01	23:45:01	20.87	0.16
5	2016/11/01	23:53:01	20.64	0.40
6	2016/11/01	23:54:01	20.82	0.19
7	2016/11/01	23:55:01	20.86	0.16
8	2016/11/01	23:56:01	20.87	0.16
9	2016/11/02	00:05:01	20.91	0.18
10	2016/11/02	00:06:01	20.70	0.34
11	2016/11/02	00:07:01	20.87	0.18
12	2016/11/02	00:08:01	20.90	0.17
13	2016/11/02	00:41:01	20.97	0.20
14	2016/11/02	00:42:01	20.77	0.36
15	2016/11/02	00:43:01	20.92	0.20
16	2016/11/02	00:44:01	20.94	0.19
17	2016/11/02	00:54:01	20.85	0.29
18	2016/11/02	00:55:01	20.80	0.30
19	2016/11/02	00:56:01	20.93	0.20
20	2016/11/02	00:57:01	20.94	0.19
21	2016/11/02	01:14:01	20.84	0.29
22	2016/11/02	01:15:01	20.85	0.26
23	2016/11/02	01:16:01	20.91	0.20
24	2016/11/02	01:17:01	20.94	0.19
25	2016/11/02	02:30:01	20.99	0.19
26	2016/11/02	02:31:01	20.82	0.33
27	2016/11/02	02:32:01	20.92	0.21
28	2016/11/02	02:33:01	20.94	0.19
29	2016/11/02	02:45:01	20.85	0.31
30	2016/11/02	02:46:01	20.83	0.29
31	2016/11/02	02:47:01	20.93	0.20
32	2016/11/02	02:48:01	20.94	0.19
33	2016/11/02	02:59:01	20.97	0.19
34	2016/11/02	03:00:01	20.75	0.39
35	2016/11/02	03:01:01	20.92	0.21
36	2016/11/02	03:02:01	20.94	0.19
37	2016/11/02	03:10:01	20.89	0.28
38	2016/11/02	03:11:01	20.79	0.34
39	2016/11/02	03:12:01	20.92	0.20
40	2016/11/02	03:13:01	20.95	0.19
41	2016/11/02	03:22:01	20.97	0.20
42	2016/11/02	03:23:01	20.76	0.37
43	2016/11/02	03:24:01	20.93	0.20
44	2016/11/02	03:25:01	20.95	0.19
45	2016/11/02	03:32:01	20.91	0.25
46	2016/11/02	03:33:01	20.75	0.37
47	2016/11/02	03:34:01	20.93	0.20
48	2016/11/02	03:35:01	20.95	0.19
49	2016/11/02	03:43:01	20.97	0.19
50	2016/11/02	03:44:01	20.76	0.37
51	2016/11/02	03:45:01	20.92	0.21
52	2016/11/02	03:46:01	20.95	0.19
53	2016/11/02	04:18:01	20.97	0.21
54	2016/11/02	04:19:01	20.79	0.36
55	2016/11/02	04:20:01	20.93	0.20
56	2016/11/02	04:21:01	20.95	0.19
57	2016/11/02	04:29:01	20.97	0.19
58	2016/11/02	04:30:01	20.83	0.33
59	2016/11/02	04:31:01	20.86	0.27
60	2016/11/02	04:32:01	20.94	0.20
61	2016/11/02	04:39:01	20.97	0.19
62	2016/11/02	04:40:01	20.75	0.40

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/11/02	04:41:01	20.92	0.21
64	2016/11/02	04:42:01	20.94	0.19
65	2016/11/02	04:51:01	20.97	0.20
66	2016/11/02	04:52:01	20.77	0.36
67	2016/11/02	04:53:01	20.93	0.20
68	2016/11/02	04:54:01	20.94	0.19
69	2016/11/02	05:02:01	20.79	0.34
70	2016/11/02	05:03:01	20.90	0.22
71	2016/11/02	05:04:01	20.94	0.19
72	2016/11/02	05:05:01	20.95	0.19
73	2016/11/02	05:16:01	20.91	0.24
74	2016/11/02	05:17:01	20.81	0.31
75	2016/11/02	05:18:01	20.94	0.19
76	2016/11/02	05:19:01	20.95	0.19
77	2016/11/02	05:29:01	20.75	0.38
78	2016/11/02	05:30:01	20.91	0.22
79	2016/11/02	05:31:01	20.93	0.19
80	2016/11/02	05:32:01	20.94	0.19
81	2016/11/02	05:45:01	20.83	0.30
82	2016/11/02	05:46:01	20.94	0.19
83	2016/11/02	05:47:01	20.96	0.19
84	2016/11/02	05:48:01	20.96	0.19
85	2016/11/02	05:56:01	20.74	0.40
86	2016/11/02	05:57:01	20.92	0.21
87	2016/11/02	05:58:01	20.95	0.19
88	2016/11/02	05:59:01	20.96	0.19
89	2016/11/02	06:11:01	20.73	0.38
90	2016/11/02	06:12:01	20.93	0.20
91	2016/11/02	06:13:01	20.95	0.19
92	2016/11/02	06:14:01	20.96	0.19
93	2016/11/02	06:25:01	20.96	0.22
94	2016/11/02	06:26:01	20.76	0.37
95	2016/11/02	06:27:01	20.92	0.20
96	2016/11/02	06:28:01	20.94	0.19
97	2016/11/02	06:38:01	20.82	0.35
98	2016/11/02	06:39:01	20.86	0.28
99	2016/11/02	06:40:01	20.95	0.19
100	2016/11/02	06:41:01	20.96	0.19
101	2016/11/02	06:50:01	20.89	0.28
102	2016/11/02	06:51:01	20.85	0.29
103	2016/11/02	06:52:01	20.95	0.19
104	2016/11/02	06:53:01	20.96	0.19
105	2016/11/02	07:42:01	20.74	0.16
106	2016/11/02	07:43:01	20.50	0.36
107	2016/11/02	07:44:01	20.67	0.18
108	2016/11/02	07:45:01	20.69	0.16
109	2016/11/02	07:56:01	20.70	0.18
110	2016/11/02	07:57:01	20.35	0.54
111	2016/11/02	07:58:01	20.52	0.34
112	2016/11/02	07:59:01	20.65	0.18
113	2016/11/02	08:09:01	20.72	0.16
114	2016/11/02	08:10:01	20.48	0.38
115	2016/11/02	08:11:01	20.65	0.18
116	2016/11/02	08:12:01	20.69	0.16
117	2016/11/02	08:24:01	20.73	0.16
118	2016/11/02	08:25:01	20.46	0.41
119	2016/11/02	08:26:01	20.64	0.19
120	2016/11/02	08:27:01	20.70	0.16
121	2016/11/02	09:07:01	20.57	0.32
122	2016/11/02	09:08:01	20.65	0.21
123	2016/11/02	09:09:01	20.69	0.17
124	2016/11/02	09:10:01	20.71	0.16
125	2016/11/02	09:23:01	20.74	0.17

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	
126	2016/11/02	09:24:01	20.51	0.37	
127	2016/11/02	09:25:01	20.66	0.20	
128	2016/11/02	09:26:01	20.70	0.17	
129	2016/11/02	09:37:01	20.74	0.17	
130	2016/11/02	09:38:01	20.50	0.37	
131	2016/11/02	09:39:01	20.68	0.18	
132	2016/11/02	09:40:01	20.70	0.17	
133	2016/11/02	09:52:01	20.73	0.17	
134	2016/11/02	09:53:01	20.53	0.35	
135	2016/11/02	09:54:01	20.64	0.22	
136	2016/11/02	09:55:01	20.70	0.17	
137	2016/11/02	10:05:01	20.65	0.25	
138	2016/11/02	10:06:01	20.58	0.27	
139	2016/11/02	10:07:01	20.69	0.17	
140	2016/11/02	10:08:01	20.71	0.17	
141	2016/11/02	10:18:01	20.68	0.21	
142	2016/11/02	10:19:01	20.50	0.35	
143	2016/11/02	10:20:01	20.68	0.18	
144	2016/11/02	10:21:01	20.71	0.17	
145	2016/11/02	10:30:01	20.73	0.17	
146	2016/11/02	10:31:01	20.54	0.34	
147	2016/11/02	10:32:01	20.65	0.19	
148	2016/11/02	10:33:01	20.69	0.17	
149	2016/11/02	10:42:01	20.74	0.16	
150	2016/11/02	10:43:01	20.49	0.39	
151	2016/11/02	10:44:01	20.62	0.22	
152	2016/11/02	10:45:01	20.70	0.17	
153	2016/11/02	10:55:01	20.72	0.17	
154	2016/11/02	10:56:01	20.51	0.34	
155	2016/11/02	10:57:01	20.68	0.17	
156	2016/11/02	10:58:01	20.71	0.17	
157	2016/11/02	11:53:01	20.73	0.16	
158	2016/11/02	11:54:01	20.49	0.38	
159	2016/11/02	11:55:01	20.66	0.18	
160	2016/11/02	11:56:01	20.69	0.16	
161	2016/11/02	12:07:01	20.68	0.22	
162	2016/11/02	12:08:01	20.54	0.31	
163	2016/11/02	12:09:01	20.67	0.16	
164	2016/11/02	12:10:01	20.71	0.16	
165	2016/11/02	12:21:01	Calibrations	being	performed
166	2016/11/02	12:22:01	Calibrations	being	performed
167	2016/11/02	12:23:01	Calibrations	being	performed
168	2016/11/02	12:24:01	Calibrations	being	performed
169	2016/11/02	12:36:01	20.42	0.43	
170	2016/11/02	12:37:01	20.64	0.17	
171	2016/11/02	12:38:01	20.68	0.16	
172	2016/11/02	12:39:01	20.69	0.16	
173	2016/11/02	12:47:01	20.71	0.15	
174	2016/11/02	12:48:01	20.42	0.42	
175	2016/11/02	12:49:01	20.62	0.19	
176	2016/11/02	12:50:01	20.67	0.15	
177	2016/11/02	13:00:01	20.66	0.19	
178	2016/11/02	13:01:01	20.45	0.36	
179	2016/11/02	13:02:01	20.64	0.16	
180	2016/11/02	13:03:01	20.67	0.15	
RUN 4 AVERAGES			**20.8**	**0.2**	

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

Client	ArcelorMittal	**Date**	Oct. 27, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 1
Unit	Quench Tower	**Start Time**	3:29
Operation	Normal	**End Time**	16:40
Tester(s)	BC, CS, JW, TM		

Cal.	LOW		MID		HIGH			Conc.	Tank ID			Response Time (sec)	
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH	Up	Down
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	44	45
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	45	44
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	0.14	0.40	0.17	0.55	0.15	20.01	0.16			
	Mid	10.21	10.17	9.99	-0.90	10.12	-0.25	0.65	20.01	10.06	19.95	20.42	d. vol. %
CO2	Zero		0.05	-0.02	-0.35	-0.05	-0.50	-0.15	19.81	-0.04			
	Mid	10.08	9.89	9.75	-0.71	9.74	-0.76	-0.05	19.81	9.75	0.03	0.06	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Nov. 1, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	10:32
Operation	Normal	**End Time**	22:28
Tester(s)	BC, CS, JW, TM		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
LIMITS				40 % to 60 %		100%					

	Upscale: Enter "Low" "Mid" or "High"			Initial Values		Final Values				Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
Gas	below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span				
O2	Zero		0.06	0.17	0.55	-0.15	-1.05	-1.60	20.01	0.01			
	Mid	10.21	10.17	10.12	-0.25	10.26	0.45	0.70	20.01	10.19	20.77	20.82	d. vol. %
CO2	Zero		0.05	-0.05	-0.50	0.15	0.50	1.01	19.81	0.05			
	Mid	10.08	9.89	9.74	-0.76	9.98	0.45	1.21	19.81	9.86	0.21	0.16	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Nov. 1-2, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 4
Unit	Quench Tower	**Start Time**	23:41
Operation	Normal	**End Time**	13:03
Tester(s)	BC, CS, JW, TM		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Span**	**Units**	**LOW**	**MID**	**HIGH**
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
LIMITS				**40 % to 60 %**		**100%**					

	Upscale: Enter "Low" "Mid" or "High"			Initial Values		Final Values				Average of Initial and Final	Average Indicated		
Gas	below "Zero"	**Actual Upscale Conc.**	**Analyzer Cal. Response**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**Drift (% of Span)**	**Span**	**System Responses**	**Gas Conc.**	**Corrected Gas Conc.**	**Conc. Units**
O2	**Zero**		0.00	-0.15	-0.75	-0.04	-0.20	0.55	20.01	-0.10			
	Mid	10.21	10.17	10.26	0.45	10.16	-0.05	-0.50	20.01	10.21	20.78	20.69	d. vol. %
CO2	**Zero**		0.20	0.15	-0.25	0.11	-0.45	-0.20	19.81	0.13			
	Mid	10.08	9.89	9.98	0.45	9.92	0.15	-0.30	19.81	9.95	0.23	0.11	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	**ZERO Analyzer Response (System for THC)**	**ZERO Analyzer Cal. Error (% of Span)**	**LOW Actual Conc.**	**LOW Analyzer Response (System for THC)**	**LOW Analyzer Cal. Error (% of Span)**	**LOW System Cal. Error (% of Actual)**	**MID Actual Conc.**	**MID Analyzer Response (System for THC)**	**MID Analyzer Cal. Error (% of Span)**	**MID System Cal. Error (% of Actual)**	**HIGH Actual Conc.**	**HIGH Analyzer Response (System for THC)**	**HIGH Analyzer Cal. Error (% of Span)**	**HIGH System Calibration Error (% of Actual)**	**Span**	**Conc. Units**
O2	0.0	0.00					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.2	1.01					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	Oct. 27, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Quench Tower		Test Start Time:	3:29 AM	
Unit Operation:	Normal		Test Finish Time:	4:40 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	
Data Input			**Calculations**		
Control Box:	1936		CO + N2	79.52	% dv
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O	Water Collected (V_f- V_i)	0.0	ml
Meter Calibration Factor (Yd)	0.998		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	180	minutes	Water Collected (W_f- W_i)	502.9	g
Barometric Pressure (Pbar)	29.14	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	23.712	scf
Stack Static Pressure (Pg)	0.01	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	23.712	scf
Stack Diameter (Ds) (L if rectangular)	600.0	inches	Volume Dry Gas Metered (Vm)	79.713	dacf
Stack Width (enter NA if circular)	216.0	inches	Vol. Dry Gas Metered Stand.(Vm(std))	77.159	dscf
Nozzle Diameter (Dn) (NA if NA)	0.337	inches	Volume Dry Gas Metered (Vm(m^3))	2.257	dacm
O2	20.42	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.185	dscm
CO2	0.06	% dv	Stack Absolute Pressure (Ps)	29.14	in. Hg
Product Rate (enter NA if not needed)	na	input ton/hr	Stack Absolute Temperature (Tsavg)	638.5	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	14.92	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	0.5121	vol. fraction
Sample Calculation Title	Toluene Soluble Organics		H2O in the gas from test data (Bws)	0.2351	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)	0.2351	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	28.83	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	26.28	lb/lb-mole
Calculations			Gas Velocity (Vs)	18.13	ft/s
Meter Temperature (Tm)	70.8	F	Is the stack circular or rectangular?	RECTANGULAR	
Stack Temperature (Tsavg)	178.8	F	Area Stack (As)	900.000	ft^2
Orifice Pressure Drop (dHavg)	0.630	in. H_2O	Actual Gas Flowrate	979,019	acfm
GasVelocity Head (dP)^avg	0.2764	in. H_2O^1/2	Standard Gas Flowrate	788,074	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	602,820	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	27,723	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	22,316	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	17,070	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000619	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	103.38	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	13.18	hours			
# of Quenches	72	quenches/test			
Avg. # of quenches per hour	3.30	quenches/hour			
Minutes per quench	5.00	minutes/quench			

	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	48	55	5.52
Container 3W		150	0.00
Container 3S	50		2.43

	Raw Mass	Blank Mass	Blank Corrected Mass	
Front-half Filter TSO Mass (mn)	8.2	9.29	0.0	mg
F1/2 Rinse TSO Mass (mn)	8.3	5.52	2.8	mg
B1/2 Water Mass (mn)	2.6	0.00	2.6	mg
B1/2 Solvent Rinse TSO Mass (mn)	6.5	2.43	4.1	mg
Total TSO Mass (mn)			9.5	mg
TSO Concentration			4.33	mg/m^3
TSO Concentration			0.0019	gr/dscf
TSO Emission Rate			NA	lb/quench
TSO Emission Rate			NA	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 Quench Tower **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	0.080	0.283	0.66	171	65	66
A-1	0.075	0.274	0.62	170	66	67
A-1	0.075	0.274	0.62	169	66	67
A-2	0.070	0.265	0.57	170	66	66
A-2	0.070	0.265	0.57	175	66	67
A-2	0.068	0.261	0.56	175	67	67
A-3	0.070	0.265	0.57	175	67	67
A-3	0.070	0.265	0.57	175	67	67
A-3	0.070	0.265	0.57	170	67	68
A-4	0.075	0.274	0.62	169	66	67
A-4	0.075	0.274	0.62	172	66	67
A-4	0.075	0.274	0.62	175	66	67
A-5	0.090	0.300	0.74	180	65	66
A-5	0.090	0.300	0.74	181	65	66
A-5	0.068	0.261	0.56	178	65	66
A-6	0.068	0.261	0.56	176	65	66
A-6	0.068	0.261	0.56	180	66	67
A-6	0.059	0.243	0.56	180	66	67
B-1	0.069	0.263	0.56	180	66	67
B-1	0.080	0.283	0.66	180	67	67
B-1	0.068	0.261	0.56	172	68	68
B-2	0.068	0.261	0.56	180	68	68
B-2	0.080	0.283	0.66	183	68	67
B-2	0.074	0.272	0.61	179	67	67
B-3	0.084	0.290	0.69	180	68	67
B-3	0.085	0.292	0.70	189	68	67
B-3	0.080	0.283	0.66	184	68	67
B-4	0.075	0.274	0.62	172	68	67
B-4	0.078	0.279	0.64	173	69	68
B-4	0.084	0.290	0.69	182	69	68
B-5	0.080	0.283	0.66	174	69	68
B-5	0.076	0.276	0.62	184	69	68
B-5	0.085	0.292	0.70	179	70	69
B-6	0.072	0.268	0.59	186	71	70
B-6	0.079	0.281	0.65	183	71	70
B-6	0.076	0.276	0.62	174	72	70
C-1	0.081	0.285	0.66	173	72	70
C-1	0.080	0.283	0.66	182	71	70
C-1	0.077	0.277	0.63	178	72	71
C-2	0.079	0.281	0.65	182	72	71
C-2	0.075	0.2739	0.62	176	74	73
C-2	0.081	0.2846	0.66	175	73	72
C-3	0.082	0.2864	0.67	182	75	74
C-3	0.076	0.2757	0.62	174	76	75
C-3	0.075	0.2739	0.62	181	77	76
C-4	0.080	0.2828	0.66	189	78	76
C-4	0.078	0.2793	0.69	180	78	77
C-4	0.077	0.2775	0.63	188	76	76
C-5	0.073	0.2702	0.60	182	75	75
C-5	0.080	0.2828	0.66	174	75	75
C-5	0.074	0.2720	0.61	184	75	75
C-6	0.071	0.2665	0.58	186	76	75
C-6	0.078	0.2793	0.64	180	76	75
C-6	0.082	0.2864	0.67	173	75	75
D-1	0.080	0.2828	0.66	185	75	75
D-1	0.076	0.2757	0.62	176	75	75
D-1	0.075	0.2739	0.62	186	75	75
D-2	0.080	0.2828	0.66	184	75	75
D-2	0.073	0.2702	0.60	181	75	74
D-2	0.078	0.2793	0.64	181	75	74
D-3	0.080	0.2828	0.66	179	76	74
D-3	0.084	0.2898	0.69	185	74	74
D-3	0.079	0.2811	0.65	177	74	74
D-4	0.074	0.2720	0.61	175	74	74
D-4	0.071	0.2665	0.58	186	74	74
D-4	0.082	0.2864	0.67	174	74	74
D-5	0.079	0.2811	0.65	181	74	74
D-5	0.077	0.2775	0.63	187	74	73
D-5	0.081	0.2846	0.66	178	74	74
D-6	0.083	0.2881	0.68	186	74	74
D-6	0.072	0.2683	0.59	181	74	74
D-6	0.077	0.2775	0.63	181	74	74
Average	0.077	0.2764	0.630	178.847		70.8

Initial volume	199.011	ft^3	Initial volume	0.000	liters
Final volume	278.724	ft^3	Final volume	0.000	liters
Total metered	79.713	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	988.9	703.7	285.2			0.0
2	854.9	673.7	181.2			0.0
3	609.7	598.5	11.2			0.0
4	840.2	814.9	25.3			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	3293.7	2790.8	502.9	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal		Test Date:	Nov. 1, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessun, PA		Test Run:	Run 3	
Unit:	Quench Tower		Test Start Time:	10:32 AM	
Unit Operation:	Normal		Test Finish Time:	10:28 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	180.0	minutes
Barometric Pressure (Pbar)	29.30	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter NA if circular)	216.0	inches
Nozzle Diameter (Dn) (NA if NA)	0.337	inches
O2	20.82	% dv
CO2	0.16	% dv
Product Rate (enter NA if not needed)	na	input ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Toluene Soluble Organics	
F_d @ 68 F and 760 mm Hg (NA if NA)	na	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	73.0	F
Stack Temperature (Tsavg)	178.4	F
Orifice Pressure Drop (dHavg)	0.694	in. H_2O
GasVelocity Head (dP)^avg	0.2793	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
Total Test Time	11.93	hours
# of Quenches	36	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	79.02	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	407.5	g
Water Vapor in Silica Gel (Vwsg(std))	19.214	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	19.214	scf
Volume Dry Gas Metered (Vm)	87.057	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	85.070	dscf
Volume Dry Gas Metered (Vm(m^3))	2.465	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.409	dscm
Stack Absolute Pressure (Ps)	29.30	in. Hg
Stack Absolute Temperature (Tsavg)	638.1	R
H2O Vapor Pressure @ avg Stack Temp.	14.77	in. Hg
H2O in the gas at saturation (Bws)	0.5041	vol. fraction
H2O in the gas from test data (Bws)	0.1842	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1842	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.86	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.86	lb/lb-mole
Gas Velocity (Vs)	18.06	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	975,439	acfm
Standard Gas Flowrate	790,070	scfm
Dry Standard Gas Flowrate	644,504	dscfm
Actual Gas Flowrate	27,621	acm/min
Standard Gas Flowrate	22,372	scm/min
Dry Standard Gas Flowrate	18,250	dscm/min
Area Nozzle (An)	0.000619	ft^2
Percent of Isokinetic Sampling (I)	106.61	%

	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	41	55	5.18
Container 3W		150	0.00
Container 3S	50		2.43

	Raw Mass	Blank Mass	Blank Corrected Mass	
Front-half Filter TSO Mass (mn)	9.5	9.29	0.2	mg
F1/2 Rinse TSO Mass (mn)	10.4	5.18	5.2	mg
B1/2 Water Mass (mn)	2.1	0.00	2.1	mg
B1/2 Solvent Rinse TSO Mass (mn)	5.0	2.43	2.6	mg
Total TSO Mass (mn)			10.1	mg
TSO Concentration			4.20	mg/m^3
TSO Concentration			0.0018	gr/dscf
TSO Emission Rate			NA	lb/quench
TSO Emission Rate			NA	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 pronting 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 pronting 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 pronting the a Montrose estimated Container 3S volume of 50 mL by the Montrose Toluene Field Blank rate (0.049 mg/mL)\

ArcelorMittal Quench Tower — **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	0.076	0.276	0.68	182	65	65
A-1	0.073	0.270	0.63	177	66	65
A-1	0.079	0.281	0.70	179	66	65
A-2	0.075	0.274	0.67	184	67	66
A-2	0.084	0.290	0.75	176	67	66
A-2	0.074	0.272	0.66	171	68	67
A-3	0.079	0.281	0.70	181	70	68
A-3	0.083	0.288	0.74	185	71	69
A-3	0.076	0.276	0.68	177	72	71
B-1	0.079	0.281	0.70	172	73	71
B-1	0.084	0.290	0.75	181	74	72
B-1	0.080	0.283	0.71	184	74	73
B-2	0.077	0.277	0.69	176	77	75
B-2	0.072	0.268	0.64	180	77	76
B-2	0.079	0.281	0.70	178	78	76
B-3	0.077	0.277	0.69	184	79	77
B-3	0.081	0.285	0.72	188	80	79
B-3	0.080	0.283	0.71	174	80	79
C-1	0.080	0.283	0.71	179	79	78
C-1	0.074	0.272	0.66	186	79	78
C-1	0.073	0.270	0.65	183	79	78
C-2	0.081	0.285	0.72	173	78	78
C-2	0.078	0.279	0.69	179	78	78
C-2	0.077	0.277	0.69	185	77	77
C-3	0.082	0.286	0.73	181	76	76
C-3	0.077	0.277	0.69	180	75	74
C-3	0.076	0.276	0.68	189	74	74
D-1	0.080	0.283	0.71	168	74	74
D-1	0.077	0.277	0.69	170	73	73
D-1	0.079	0.281	0.70	172	72	72
D-2	0.079	0.281	0.70	170	72	72
D-2	0.076	0.276	0.68	165	71	71
D-2	0.076	0.276	0.68	179	71	71
D-3	0.080	0.283	0.71	185	71	70
D-3	0.076	0.276	0.68	180	70	70
D-3	0.080	0.283	0.71	169	70	71
Average	0.078	0.2793	0.694	178.389		73.0

Initial volume	805.717	ft^3	Initial volume	0.000	liters
Final volume	892.774	ft^3	Final volume	0.000	liters
Total metered	87.057	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	952.5	707.2	245.3			0.0
2	856.8	717.2	139.6			0.0
3	613.8	612	1.8			0.0
4	800.1	779.3	20.8			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	3223.2	2815.7	407.5	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:	Nov. 1-2, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 4	
Unit:	Quench Tower		Test Start Time:	11:41 PM	
Unit Operation:	Normal		Test Finish Time:	1:03 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774		**Calculations**		
Meter DH@ (0.75 scfm)	1.977	in. H_2O	CO + N2	79.21	% dv
Meter Calibration Factor (Yd)	1.006		Water Collected (V_f- V_i)	0.0	ml
Test Time (Theta)	180	minutes	Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.30	in. Hg	Water Collected (W_f- W_i)	401.6	g
Stack Static Pressure (Pg)	0.01	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	18.935	scf
Stack Diameter (Ds) (L if rectangular)	600.0	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	18.935	scf
Stack Width (enter NA if circular)	216.0	inches	Volume Dry Gas Metered (Vm)	82.861	dacf
Nozzle Diameter (Dn) (NA if NA)	0.337	inches	Vol. Dry Gas Metered Stand.(Vm(std))	81.444	dscf
O2	20.69	% dv	Volume Dry Gas Metered ($Vm(m^3)$)	2.346	dacm
CO2	0.11	% dv	Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	2.306	dscm
Product Rate (enter NA if not needed)	na	input ton/hr	Stack Absolute Pressure (Ps)	29.30	in. Hg
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Temperature (Tsavg)	631.4	R
Pitot Tube Coefficient (Cp)	0.84		H2O Vapor Pressure @ avg Stack Temp.	12.72	in. Hg
Sample Calculation Title	Toluene Soluble Organics		H2O in the gas at saturation (Bws)	0.4342	vol. fraction
F_d @ 68 F and 760 mm Hg (NA if NA)	na	dscf/MMBtu	H2O in the gas from test data (Bws)	0.1886	vol. fraction
Standard Temperature	68	F	H2O in the gas used (lower of the 2 Bws)	0.1886	vol. fraction
Standard Pressure	760	mm Hg	Is the Gas Stream Saturated With H2O?	NO	
Pitot Tube Constant (Kp)	85.49		Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Calculations			Wet Gas Molecular Weight (Ms)	26.80	lb/lb-mole
Meter Temperature (Tm)	69.9	F	Gas Velocity (Vs)	17.53	ft/s
Stack Temperature (Tsavg)	171.8	F	Is the stack circular or rectangular?	RECTANGULAR	
Orifice Pressure Drop (dHavg)	0.661	in. H_2O	Area Stack (As)	900.000	ft^2
(dsVelocity Head (dP)^1/2 avg	0.2722	in. H_2O^1/2	Actual Gas Flowrate	946,765	acfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Standard Gas Flowrate	774,869	scfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Dry Standard Gas Flowrate	628,699	dscfm
Heat Input Based on F_d	NA	MMBtu/hr	Actual Gas Flowrate	26,810	acm/min
K1method 4	0.04706	scf/ml	Standard Gas Flowrate	21,942	scm/min
K2method 4	0.04715	scf/g	Dry Standard Gas Flowrate	17,803	dscm/min
K1method 5	17.64	R/in. Hg	Area Nozzle (An)	0.000619	ft^2
K4method 5	0.0945		Percent of Isokinetic Sampling (I)	104.63	%
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	13.37	hours			
# of Quenches	36	quenches/test			
Avg. # of quenches per hour	3.30	quenches/hour			
Minutes per quench	5.00	minutes/quench			

	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	48	55	5.52
Container 3W		150	0.00
Container 3S	50		2.43

	Raw Mass	Blank Mass	Blank Corrected Mass	
Front-half Filter TSO Mass (mn)	8.1	9.29	0.0	mg
F1/2 Rinse TSO Mass (mn)	8.6	5.52	3.1	mg
B1/2 Water Mass (mn)	2.1	0.00	2.1	mg
B1/2 Solvent Rinse TSO Mass (mn)	3.4	2.43	1.0	mg
Total TSO Mass (mn)			6.2	mg
TSO Concentration			2.67	mg/m^3
TSO Concentration			0.0012	gr/dscf
TSO Emission Rate			NA	lb/quench
TSO Emission Rate			NA	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 a Montrose estimated Container 3S volume of 50 mL by the Montrose Toluene Field Blank rate (0.049 mg/mL)\

ArcelorMittal Quench Tower **Run 4** **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	0.076	0.276	0.68	175	74	75
A-1	0.076	0.276	0.68	175	74	75
A-1	0.069	0.263	0.61	179	73	75
A-2	0.072	0.268	0.64	167	72	73
A-2	0.072	0.268	0.64	169	70	71
A-2	0.080	0.283	0.71	165	70	71
A-3	0.080	0.283	0.71	181	72	73
A-3	0.077	0.277	0.64	169	72	73
A-3	0.076	0.276	0.68	170	72	73
B-1	0.070	0.265	0.62	175	72	73
B-1	0.069	0.263	0.61	172	73	74
B-1	0.076	0.276	0.68	178	72	72
B-2	0.078	0.279	0.69	180	72	72
B-2	0.078	0.279	0.69	182	71	72
B-2	0.078	0.279	0.69	180	71	71
B-3	0.072	0.268	0.64	176	71	71
B-3	0.060	0.245	0.61	167	71	71
B-3	0.075	0.274	0.67	170	71	72
C-1	0.075	0.274	0.67	170	71	72
C-1	0.078	0.279	0.69	165	71	72
C-1	0.080	0.283	0.71	160	72	72
C-2	0.077	0.277	0.69	171	66	67
C-2	0.075	0.274	0.67	169	66	66
C-2	0.074	0.272	0.66	170	66	66
C-3	0.076	0.276	0.68	166	65	65
C-3	0.073	0.270	0.65	169	65	65
C-3	0.072	0.268	0.64	172	65	65
D-1	0.075	0.274	0.67	171	66	65
D-1	0.071	0.266	0.63	168	66	65
D-1	0.074	0.272	0.66	170	66	66
D-2	0.069	0.263	0.61	174	67	66
D-2	0.072	0.268	0.64	171	67	67
D-2	0.075	0.274	0.67	173	68	66
D-3	0.071	0.266	0.63	171	68	67
D-3	0.073	0.270	0.65	170	71	70
D-3	0.075	0.274	0.67	174	72	71
Average	0.074	0.2722	0.661	171.778		69.9

Initial volume	893.120	ft^3	Initial volume	0.000	liters
Final volume	975.981	ft^3	Final volume	0.000	liters
Total metered	82.861	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	936.8	697.9	238.9			0.0
2	827.4	685.4	142.0			0.0
3	625.6	622.9	2.7			0.0
4	795.5	777.5	18.0			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	3185.3	2783.7	401.6	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

MONTROSE METHOD 5/315 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 315 (TSO)	Meter ΔH :	1.830	Start Time:	3:29
Date:	10-27-16	Run Number:	1	Meter Correction (γ):	0.998	Stop Time:	16:40
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.337	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	+.01	Control Box ID:	MB: 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.14	Assumed Moisture (%):	20	Pitot ID:	9-6
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	55°F	Umbilical Length (Feet):	200'	Filter ID:	7214
Test Crew:	JV JW TL CB TM (Initials)	Initial K-factor	8.2			Stack Diameter (inches):	600 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 199.011	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	199.209	0.080	0.656	2	171	248	248	50	65	66	
A-1	0:05:00	200.999	0.075	0.62	2	170	248	248	49	66	67	
A-1	0:07:30	202.130	0.075	0.62	2	169	248	248	45	66	67	3:44
A-2	0:10:00	203.181	0.070	0.57	2	170	248	248	46	66	66	4:03
A-2	0:12:30	204.121	0.070	0.57	2	175	248	248	46	66	67	
A-2	0:15:00	205.241	0.068	0.56	2	175	248	248	48	67	67	4:12
A-3	0:17:30	205.712	0.070	0.57	2	175	248	248	49	67	67	4:24
A-3	0:20:00	206.815	0.070	0.57	2	175	248	248	48	67	67	
A-3	0:22:30	207.940	0.070	0.057	2	170	248	248	50	67	68	4:36
A-4	0:25:00	208.982	0.075	0.062	2	169	248	248	50	66	67	
A-4	0:27:30	210.053	0.075	0.062	2	172	248	248	48	66	67	
A-4	0:30:00	211.106	0.075	0.062	2	175	248	248	48	66	67	5:02
A-5	0:32:30	212.206	0.090	0.738	2	180	248	248	50	65	66	5:24
A-5	0:35:00	213.321	0.090	0.74	2	179	249	248	51	65	66	
A-5	0:37:30	214.201	0.068	0.56	2	178	248	247	50	65	66	5:56
A-6	0:40:00	215.492	0.068	0.56	2	176	248	248	50	65	66	6:05
A-6	0:42:30	216.428	0.068	0.56	2	180	248	248	50	66	67	6:24
A-6	0:45:00	217.344	0.069	0.56	2	180	248	248	50	66	67	
B-1	0:47:30	218.595	0.069	0.56	2	180	248	248	50	66	67	6:33
B-1	0:50:00	219.637	0.080	0.66	2	180	248	248	50	67	67	
B-1	0:52:30	220.705	0.068	0.56	2	172	248	248	50	68	68	
B-2	0:55:00	221.726	0.068	0.56	2	180	240	248	50	68	68	6:50
B-2	0:57:30	222.65	.080	.66	2	183	249	248	52	66	67	
B-2	1:00:00	224.18	.074	.61	2	179	248	246	54	67	67	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	0.000	10
Check	Final	5	0.000
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

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

Imp	Contents	Final	Initial	Difference
1	DI H_2O (g)	988.9	703.7	
2	DI H_2O (g)	854.9	673.7	
3	Empty (g)	607.7	597.5	
4	Silica (g)	840.2	814.9	

MONTROSE METHOD 5/315 DATA SHEET

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

Date: 10-27-16 **Run Number:** 1 **Sampling Location:** Quench Tower Outlet

Test Crew: JV JW TL CB TM

(Please Circle Initials of Meter Box Operator) 8.2

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-3	1:02:30	225.04	.084	.69	2	180	248	248	54	68	67	
B-3	1:05:00	226.18	.085	.70	2	189	245	247	56	68	67	
B-3	1:07:30	227.33	.080	.66	2	184	246	247	56	68	67	
B-4	1:10:00	228.47	.075	.62	2	172	248	249	53	68	67	
B-4	1:12:30	229.58	.078	.64	2	173	247	246	52	69	68	
B-4	1:15:00	230.73	.084	.69	2	182	248	248	52	69	68	
B-5	1:17:30	232.61	.080	.66	2	174	247	248	53	69	68	
B-5	1:20:00	233.04	.076	.62	2	184	247	246	53	69	68	
B-5	1:22:30	234.24	.085	.70	2	179	246	246	55	70	69	
B-6	1:25:00	235.40	.072	.59	2	186	248	248	55	71	70	
B-6	1:27:30	236.73	.079	.65	2	183	249	249	56	71	70	
B-6	1:30:00	237.61	.076	.62	2	174	246	248	56	72	70	
C-1	1:32:30	238.80	.081	.66	2	173	249	250	56	72	70	
C-1	1:35:00	239.93	.080	.66	2	182	245	247	57	71	70	
C-1	1:37:30	241.04	.077	.63	2	178	247	248	63	72	71	
C-2	1:40:00	242.21	.079	.65	2	182	249	247	62	72	71	
C-2	1:42:30	243.33	.075	.62	2	176	247	248	63	74	73	
C-2	1:45:00	244.46	.081	.66	2	175	248	247	63	73	72	
C-3	1:47:30	245.65	.082	.67	2	182	246	247	62	75	74	
C-3	1:50:00	246.81	.076	.62	2	174	249	248	61	76	75	
C-3	1:52:30	247.59	.075	.62	2	181	249	250	59	77	76	
C-4	1:55:00	249.09	.080	.66	2	189	244	246	60	78	76	
C-4	1:57:30	250.25	.078	.64	2	180	246	247	58	78	77	
C-4	2:00:00	251.42	.077	.63	2	168	245	247	57	76	76	
C-5	2:02:30	252.11	.073	.60	2	182	247	247	57	75	75	
C-5	2:05:00	253.68	.080	.66	2	174	246	248	57	75	75	
C-5	2:07:30	254.79	.074	.61	2	184	248	247	58	78	75	
C-6	2:10:00	255.93	.071	.58	2	186	247	247	59	76	75	
C-6	2:12:30	257.16	.078	.64	2	180	249	247	59	76	75	
C-6	2:15:00	258.19	.082	.67	2	173	247	248	63	75	75	
D-1	2:17:30	259.36	.080	.66	2	185	249	248	62	75	75	
D-1	2:20:00	260.49	.076	.62	2	176	247	247	63	75	75	
D-1	2:22:30	261.59	.075	.62	2	186	246	247	64	75	75	
D-2	2:25:00	262.74	.080	.66	2	184	248	248	64	75	75	
D-2	2:27:30	263.05	.073	.60	2	181	245	246	64	75	74	
D-2	2:30:00	264.90	.078	.64	2	181	248	248	65	75	74	
D-3	2:32:30	266.27	.080	.66	2	179	248	246	65	76	74	
D-3	2:35:00	267.43	.084	.69	2	185	246	247	63	74	74	

MONTROSE METHOD 5/315 DATA SHEET

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

Date: 10-27-16 **Run Number:** 1 **Sampling Location:** Quench Tower Outlet

Test Crew: JV JW TL CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
D-3	2:37:30	268.56	.079	.65	2	177	248	247	64	74	74	
D-4	2:40:00	269.91	.074	.61	2	175	247	247	64	74	74	
D-4	2:42:30	270.77	.071	.58	2	186	246	248	65	74	74	
D-4	2:45:00	271.84	.082	.67	2	179	247	248	64	74	74	
D-5	2:47:30	273.06	.079	.65	2	181	247	247	65	74	74	
D-5	2:50:00	274.19	.077	.63	2	187	249	247	65	74	73	
D-5	2:52:30	275.70	.081	.66	2	178	248	246	64	74	74	
D-6	2:55:00	276.52	.083	.68	2	186	247	248	63	74	74	
D-6	2:57:30	277.61	.072	.59	2	181	248	247	65	74	74	
D-6	3:00:00	278.729	.077	.63	2	181	247	247	64	74	74	stop 1640

MONTROSE METHOD 5/315 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 315 (TSO)	Meter ΔH :	1.977	Start Time:	10:32
Date:	11-1-16	Run Number:	3	Meter Correction (γ):	1.006	Stop Time:	22:28
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.337	Pitot Correction:	0.84	T/C ID:	9-2
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	0.01	Control Box ID:	MB 1774	Probe ID:	9-2
		Baro. Pres. (in. Hg):	29.30	Assumed Moisture (%):	20	Pitot ID:	9-2
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	62	Umbilical Length (Feet):	200'	Filter ID:	7192
Test Crew:	JV JW TL CB TM	Initial K-factor	8.9			Stack Diameter (inches):	600 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 805.717	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	0:05:00	808.09	.076	.68	3	182	255	255	46	65	65	10:46
A-1	0:10:00	810.35	.073	.65	3	177	259	255	47	66	65	11:01
A-1	0:15:00	812.67	.079	.70	3	179	260	254	48	66	65	11:16
A-2	0:20:00	814.918	.075	.67	3	184	259	255	48	67	66	12:00
A-2	0:25:00	817.32	.084	.75	3	176	259	254	50	67	66	12:24
A-2	0:30:00	819.51	.074	.66	3	171	258	255	52	68	67	12:39
A-3	0:35:00	821.94	.079	.70	3	181	259	255	54	70	68	12:53
A-3	0:40:00	824.339	.083	.74	3	185	255	254	55	71	69	13:07
A-3	0:45:00	826.68	.076	.68	3	177	257	255	61	72	71	13:29
B-1	0:50:00	829.05	.079	.70	3	172	254	254	62	73	71	13:43
B-1	0:55:00	831.49	.084	.75	3	181	256	255	62	74	72	14:18
B-1	1:00:00	833.830	.080	.71	3	184	256	254	61	74	73	14:31
B-2	1:05:00	836.18	.077	.69	3	176	258	255	59	77	75	14:54
B-2	1:10:00	838.63	.072	.64	3	180	259	256	55	77	76	15:07
B-2	1:15:00	840.81	.079	.70	3	178	259	256	51	78	76	15:21
B-3	1:20:00	843.153	.077	.69	3	184	256	255	54	79	77	15:40
B-3	1:25:00	846.11	.081	.72	3	188	258	255	60	80	79	16:03
B-3	1:30:00	848.57	.080	.71	3	174	256	255	60	80	79	16:50
C-1	1:35:00	851.01	.080	.71	3	179	259	254	62	79	78	17:02
C-1	1:40:00	854.034	.074	.66	3	186	258	255	62	79	78	17:18
C-1	1:45:00	856.36	.073	.65	3	183	256	254	65	79	78	17:39
C-2	1:50:00	858.76	.081	.72	3	173	259	255	65	78	78	17:52
C-2	1:55:00	861.11	.078	.69	3	179	257	254	65	78	78	18:06
C-2	2:00:00	863.324	.077	.69	3	185	254	255	67	77	77	18:20

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.006
Check	Final	14	0.000
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

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

Imp	Contents	Final	Initial	Difference
1	DI H_2O (g)	952.5	707.2	
2	DI H_2O (g)	856.8	717.2	
3	Empty (g)	613.8	612.0	
4	Silica (g)	800.1	779.3	

MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal
Test Type: Method 315 (TSO)
Project Number: Proj106377 (16-167)
Date: 11-1-16
Run Number: 3
Sampling Location: Quench Tower Outlet
Test Crew: JV JW TL CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	2:05:00	865.435	.082	.73	3	181	260	255	66	76	76	19:12
C-3	2:10:00	868.223	0.077	0.69	3	180	260	254	65	75	74	19:25
C-3	2:15:00	870.550	0.076	0.68	3	189	259	255	45	74	74	18:38
D-1	2:20:00	872.969	0.080	0.71	3	188	260	254	47	74	74	19:52
D-1	2:25:00	875.077	0.077	0.69	3	170	260	254	47	73	73	20:05
D-1	2:30:00	878.139	.079	0.70	3	172	260	254	50	72	72	20:18
D-2	2:35:00	880.491	0.079	0.70	3	170	258	255	51	72	72	20:30
D-2	2:40:00	883.080	0.076	0.68	3	165	250	256	52	71	71	20 43
D-2	2:45:00	885.401	0.076	0.68	3	179	252	253	55	71 ~~78~~	71	21:05 21:41
D-3	2:50:00	887.892	0.080	0.71	3	185	250	255	56	71	70	21:57
D-3	2:55:00	890.304	0.076	0.68	3	180	251	256	57	70	70	22:06 22:16
D-3	3:00:00	892.774	0.080	0.71	3	169	245	255	56	70	71	22:26

315

MONTROSE METHOD 5/315 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 315 (TSO)	Meter ΔH :	1.997	Start Time:	23:41
Date:	11-1-16 - 11-2-16	Run Number:	4	Meter Correction (γ):	1.006	Stop Time:	13:03
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.337	Pitot Correction:	0.84	T/C ID:	9-2
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	0.01	Control Box ID:	MB: 1774	Probe ID:	9-2
		Baro. Pres. (in. Hg):	29.30	Assumed Moisture (%):	20	Pitot ID:	9-2
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	62	Umbilical Length (Feet):	200'	Filter ID:	7191
Test Crew:	JV JW TL CB TM BTP JB	Initial K-factor	8.9			Stack Diameter (inches):	600 x 216 RECT

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 893.120	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	0:05:00	895.736	0.076	0.68	3	175	250	256	56	74	75	23:41
A-1	0:10:00	897.931	0.076	0.68	3	175	249	251	55	74	75	23:52
A-1	0:15:00	900.242	0.069	0.61	3	179	250	256	56	73	75	0:04
A-2	0:20:00	902.415	0.072	0.64	3	167	248	256	55	72	73	0:40
A-2	0:25:00	905.001	0.072	0.64	3	169	248	255	51	70	71	0:53 ← Plant issues
A-2	0:30:00	907.070	0.080	0.71	3	165	249	256	52	70	71	2:28
A-3	0:35:00	909.724	0.080	0.71	3	181	252	255	52	72	73	2:44 3:01
A-3	0:40:00	911.978	0.077	0.64	3	169	250	254	53	72	73	3:08
A-3	0:45:00	914.242	0.076	0.68	3	170	248	254	44	72	73	3:22
B-1	0:50:00	916.505	0.070	0.62	3	175	249	254	44	72	73	3:32
B-1	0:55:00	918.748	0.069	0.61	3	172	249	255	49	73	74	3:42 4:18
B-1	1:00:00	921.111	0.076	0.68	3	178	250	256	49	72	72	4:29
B-2	1:05:00	923.422	0.078	0.69	3	180	248	256	48	72	72	4:40
B-2	1:10:00	925.807	0.078	0.69	3	182	250	254	47	71	72	4:50
B-2	1:15:00	928.212	0.078	0.69	3	180	248	256	47	71	71	5:00 5:16
B-3	1:20:00	930.602	0.072	0.64	3	176	245	255	49	71	71	5:28
B-3	1:25:00	932.801	0.066	0.61	3	167	250	254	53	71	71	5:43
B-3	1:30:00	935.089	0.075	0.67	3	170	250	253	53	71	72	5:55
C-1	1:35:00	937.450	0.075	0.67	3	170	247	255	52	71	72	6:08
C-1	1:40:00	939.750	0.078	0.69	3	165	246	255	52	71	72	6:25 6:37
C-1	1:45:00	942.161	0.080	0.71	3	160	250	255	53	72	72	6:49
C-2	1:50:00	944.464	0.077	0.69	3	171	251	253	52	66	67	7:41
C-2	1:55:00	946.726	0.075	0.67	3	169	249	254	51	66	66	7:55
C-2	2:00:00	948.958	0.074	.66	3	170	247	254	52	66	66	8:09

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.001
Check	Final	6	0.004
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

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

Imp	Contents	Final	Initial	Difference
1	DI H_2O (g)	936.8	697.9	
2	DI H_2O (g)	827.4	685.4	
3	Empty (g)	625.6	622.9	
4	Silica (g)	795.5	777.5	

MONTROSE METHOD 5/315 DATA SHEET

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

Date: **Run Number:** **Sampling Location:** Quench Tower Outlet

Test Crew: JV JW TL CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	2:05:00	951.238	0.076	0.68	3	166	245	254	56	65	65	~~8:23~~ 9:06
C-3	2:10:00	953.527	0.073	0.65	3	169	241	248	60	65	65	~~9:23~~ 9:37
C-3	2:15:00	955.761	0.072	0.64	3	172	255	253	55	65	65	~~9:37~~ 9:52
D-1	2:20:00	958.013	0.075	0.67	3	171	249	256	57	66	65	10:04
D-1	2:25:00	960.261	0.071	0.63	3	168	246	254	59	66	65	10:17
D-1	2:30:00	962.515	0.074	.66	3	170	251	255	60	66	66	10:30
D-2	2:35:00	964.780	0.069	0.61	3	174	249	255	62	67	66	10:41
D-2	2:40:00	966.935	0.072	0.64	3	171	246	256	64	67	67	10:55
D-2	2:45:00	969.095	0.075	0.67	3	173	249	254	60	68	66	12:06
D-3	2:50:00	971.396	0.071	0.63	3	171	248	255	62	68	67	12:20
D-3	2:55:00	973.615	0.073	0.65	3	170	248	255	60	71	70	12:39
D-3	3:00:00	975.981	0.075	0.67	3	174	245	255	61	72	71	12:46

Method 316

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/25	09:10:01	19.32	0.01
2	2016/10/25	09:11:01	19.32	0.00
3	2016/10/25	09:12:01	19.19	0.02
4	2016/10/25	09:13:01	19.33	0.03
5	2016/10/25	09:21:01	19.33	0.01
6	2016/10/25	09:22:01	19.31	0.00
7	2016/10/25	09:23:01	19.04	0.03
8	2016/10/25	09:24:01	19.31	0.03
9	2016/10/25	09:36:01	19.35	0.00
10	2016/10/25	09:37:01	19.16	0.02
11	2016/10/25	09:38:01	19.33	0.04
12	2016/10/25	09:39:01	19.33	0.01
13	2016/10/25	09:49:01	19.36	0.04
14	2016/10/25	09:50:01	19.06	0.02
15	2016/10/25	09:51:01	19.34	0.01
16	2016/10/25	09:52:01	19.33	0.02
17	2016/10/25	10:42:01	19.36	0.00
18	2016/10/25	10:43:01	18.96	0.02
19	2016/10/25	10:44:01	19.34	0.03
20	2016/10/25	10:45:01	19.34	0.00
21	2016/10/25	10:54:01	19.39	0.02
22	2016/10/25	10:55:01	19.36	0.03
23	2016/10/25	10:56:01	19.20	0.00
24	2016/10/25	10:57:01	19.34	0.02
25	2016/10/25	11:06:01	19.35	0.02
26	2016/10/25	11:07:01	19.36	0.00
27	2016/10/25	11:08:01	19.08	0.02
28	2016/10/25	11:09:01	19.36	0.04
29	2016/10/25	11:20:01	19.36	0.04
30	2016/10/25	11:21:01	19.27	0.02
31	2016/10/25	11:22:01	19.32	0.00
32	2016/10/25	11:23:01	19.35	0.02
33	2016/10/25	11:34:01	19.36	0.02
34	2016/10/25	11:35:01	19.29	0.03
35	2016/10/25	11:36:01	19.34	0.00
36	2016/10/25	11:37:01	19.34	0.01
37	2016/10/25	11:48:01	19.36	0.02
38	2016/10/25	11:49:01	19.35	0.03
39	2016/10/25	11:50:01	19.27	0.02
40	2016/10/25	11:51:01	19.34	0.00
41	2016/10/25	12:16:01	19.34	0.00
42	2016/10/25	12:17:01	19.29	0.02
43	2016/10/25	12:18:01	19.34	0.03
44	2016/10/25	12:19:01	19.33	0.02
45	2016/10/25	12:30:01	19.35	0.02
46	2016/10/25	12:31:01	19.20	0.00
47	2016/10/25	12:32:01	19.31	0.02
48	2016/10/25	12:33:01	19.34	0.03
49	2016/10/25	12:44:01	19.33	0.03
50	2016/10/25	12:45:01	19.00	0.01
51	2016/10/25	12:46:01	19.31	0.03
52	2016/10/25	12:47:01	19.34	0.03
53	2016/10/25	12:58:01	19.33	0.03
54	2016/10/25	12:59:01	19.34	0.02
55	2016/10/25	13:00:01	18.97	0.00
56	2016/10/25	13:01:01	19.30	0.02
57	2016/10/25	13:34:01	19.31	0.02
58	2016/10/25	13:35:01	19.26	0.04
59	2016/10/25	13:36:01	19.29	0.01
60	2016/10/25	13:37:01	19.29	0.01
61	2016/10/25	13:45:01	19.28	0.03
62	2016/10/25	13:46:01	19.29	0.03

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/25	13:47:01	19.03	0.00
64	2016/10/25	13:48:01	19.26	0.02
65	2016/10/25	13:55:01	19.28	0.00
66	2016/10/25	13:56:01	19.30	0.03
67	2016/10/25	13:57:01	19.29	0.03
68	2016/10/25	13:58:01	19.27	0.00
69	2016/10/25	14:08:01	19.30	0.02
70	2016/10/25	14:09:01	19.31	0.00
71	2016/10/25	14:10:01	18.96	0.02
72	2016/10/25	14:11:01	19.27	0.04
73	2016/10/25	14:19:01	19.32	0.02
74	2016/10/25	14:20:01	19.32	0.00
75	2016/10/25	14:21:01	18.96	0.02
76	2016/10/25	14:22:01	19.28	0.05
77	2016/10/25	14:34:01	19.32	0.01
78	2016/10/25	14:35:01	19.20	0.00
79	2016/10/25	14:36:01	19.30	0.03
80	2016/10/25	14:37:01	19.31	0.03
81	2016/10/25	14:54:01	19.32	0.02
82	2016/10/25	14:55:01	18.86	0.03
83	2016/10/25	14:56:01	19.29	0.03
84	2016/10/25	14:57:01	19.31	0.01
85	2016/10/25	15:08:01	19.34	0.01
86	2016/10/25	15:09:01	19.33	0.04
87	2016/10/25	15:10:01	19.24	0.02
88	2016/10/25	15:11:01	19.32	0.00
89	2016/10/25	15:39:01	19.32	0.02
90	2016/10/25	15:40:01	19.32	0.00
91	2016/10/25	15:41:01	19.18	0.02
92	2016/10/25	15:42:01	19.30	0.04
93	2016/10/25	15:55:01	19.33	0.01
94	2016/10/25	15:56:01	19.20	0.03
95	2016/10/25	15:57:01	19.28	0.02
96	2016/10/25	15:58:01	19.32	0.00
97	2016/10/25	16:19:01	19.32	0.02
98	2016/10/25	16:20:01	19.09	0.00
99	2016/10/25	16:21:01	19.30	0.02
100	2016/10/25	16:22:01	19.32	0.04
101	2016/10/25	16:34:01	19.32	0.01
102	2016/10/25	16:35:01	19.02	0.00
103	2016/10/25	16:36:01	19.30	0.04
104	2016/10/25	16:37:01	19.31	0.02
105	2016/10/25	16:48:01	19.32	0.02
106	2016/10/25	16:49:01	19.17	0.00
107	2016/10/25	16:50:01	19.27	0.02
108	2016/10/25	16:51:01	19.33	0.04
109	2016/10/25	17:02:01	19.32	0.04
110	2016/10/25	17:03:01	19.19	0.02
111	2016/10/25	17:04:01	19.27	0.00
112	2016/10/25	17:05:01	19.31	0.03
113	2016/10/25	17:16:01	19.31	0.03
114	2016/10/25	17:17:01	19.22	0.02
115	2016/10/25	17:18:01	19.29	0.00
116	2016/10/25	17:19:01	19.30	0.02
117	2016/10/25	17:29:01	19.31	0.00
118	2016/10/25	17:30:01	19.31	0.02
119	2016/10/25	17:31:01	19.07	0.04
120	2016/10/25	17:32:01	19.30	0.02
RUN 1 AVERAGES			**19.27**	**0.02**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
Run 2				
1	2016/10/25	18:07:01	19.31	0.03
2	2016/10/25	18:08:01	19.30	0.02
3	2016/10/25	18:09:01	19.29	0.00
4	2016/10/25	18:10:01	19.24	0.02
5	2016/10/25	18:22:01	19.30	0.04
6	2016/10/25	18:23:01	19.20	0.02
7	2016/10/25	18:24:01	19.29	0.00
8	2016/10/25	18:25:01	19.30	0.03
9	2016/10/25	18:33:01	19.31	0.04
10	2016/10/25	18:34:01	19.32	0.01
11	2016/10/25	18:35:01	19.03	0.00
12	2016/10/25	18:36:01	19.28	0.03
13	2016/10/25	19:07:01	19.33	0.00
14	2016/10/25	19:08:01	19.33	0.01
15	2016/10/25	19:09:01	19.25	0.03
16	2016/10/25	19:10:01	19.32	0.02
17	2016/10/25	19:21:01	19.33	0.02
18	2016/10/25	19:22:01	19.02	0.00
19	2016/10/25	19:23:01	19.29	0.02
20	2016/10/25	19:24:01	19.31	0.03
21	2016/10/25	19:34:01	19.33	0.02
22	2016/10/25	19:35:01	19.23	0.03
23	2016/10/25	19:36:01	19.28	0.01
24	2016/10/25	19:37:01	19.34	0.00
25	2016/10/25	19:53:01	19.35	0.04
26	2016/10/25	19:54:01	19.34	0.02
27	2016/10/25	19:55:01	19.09	0.00
28	2016/10/25	19:56:01	19.32	0.02
29	2016/10/25	20:07:01	19.34	0.02
30	2016/10/25	20:08:01	19.29	0.03
31	2016/10/25	20:09:01	19.35	0.00
32	2016/10/25	20:10:01	19.35	0.01
33	2016/10/25	20:19:01	19.34	0.02
34	2016/10/25	20:20:01	19.35	0.00
35	2016/10/25	20:21:01	19.11	0.02
36	2016/10/25	20:22:01	19.33	0.04
37	2016/10/25	20:33:01	19.33	0.03
38	2016/10/25	20:34:01	19.07	0.02
39	2016/10/25	20:35:01	19.32	0.00
40	2016/10/25	20:36:01	19.34	0.02
41	2016/10/25	20:56:01	19.34	0.02
42	2016/10/25	20:57:01	19.29	0.00
43	2016/10/25	20:58:01	19.33	0.02
44	2016/10/25	20:59:01	19.32	0.02
45	2016/10/25	21:17:01	19.32	0.03
46	2016/10/25	21:18:01	19.30	0.01
47	2016/10/25	21:19:01	19.29	0.00
48	2016/10/25	21:20:01	19.29	0.03
49	2016/10/26	12:24:01	19.44	0.02
50	2016/10/26	12:25:01	19.38	0.01
51	2016/10/26	12:26:01	19.43	0.02
52	2016/10/26	12:27:01	19.42	0.03
53	2016/10/26	12:46:01	19.40	0.02
54	2016/10/26	12:47:01	19.38	0.00
55	2016/10/26	12:48:01	19.28	0.02
56	2016/10/26	12:49:01	19.38	0.03
57	2016/10/26	12:59:01	19.36	0.02
58	2016/10/26	13:00:01	19.30	0.04
59	2016/10/26	13:01:01	19.35	0.01
60	2016/10/26	13:02:01	19.36	0.01
61	2016/10/26	13:11:01	19.35	0.03
62	2016/10/26	13:12:01	18.96	0.01

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/26	13:13:01	19.34	0.03
64	2016/10/26	13:14:01	19.34	0.03
65	2016/10/26	13:23:01	19.32	0.00
66	2016/10/26	13:24:01	19.10	0.02
67	2016/10/26	13:25:01	19.31	0.04
68	2016/10/26	13:26:01	19.32	0.02
69	2016/10/26	13:36:01	19.31	0.03
70	2016/10/26	13:37:01	19.31	0.02
71	2016/10/26	13:38:01	19.23	0.01
72	2016/10/26	13:39:01	19.31	0.03
73	2016/10/26	13:49:01	19.31	0.01
74	2016/10/26	13:50:01	19.24	0.03
75	2016/10/26	13:51:01	19.29	0.03
76	2016/10/26	13:52:01	19.29	0.00
77	2016/10/26	14:00:01	19.29	0.01
78	2016/10/26	14:01:01	19.23	0.04
79	2016/10/26	14:02:01	19.28	0.02
80	2016/10/26	14:03:01	19.29	0.00
81	2016/10/26	14:19:01	19.28	0.03
82	2016/10/26	14:20:01	19.21	0.03
83	2016/10/26	14:21:01	19.28	0.00
84	2016/10/26	14:22:01	19.28	0.02
85	2016/10/26	14:30:01	19.28	0.04
86	2016/10/26	14:31:01	19.12	0.03
87	2016/10/26	14:32:01	19.28	0.00
88	2016/10/26	14:33:01	19.29	0.02
89	2016/10/26	14:42:01	19.29	0.02
90	2016/10/26	14:43:01	18.99	0.00
91	2016/10/26	14:44:01	19.27	0.02
92	2016/10/26	14:45:01	19.28	0.03
93	2016/10/26	14:55:01	19.26	0.02
94	2016/10/26	14:56:01	19.21	0.04
95	2016/10/26	14:57:01	19.28	0.01
96	2016/10/26	14:58:01	19.28	0.01
97	2016/10/26	15:07:01	19.30	0.03
98	2016/10/26	15:08:01	19.05	0.01
99	2016/10/26	15:09:01	19.28	0.02
100	2016/10/26	15:10:01	19.29	0.04
101	2016/10/26	15:36:01	19.30	0.03
102	2016/10/26	15:37:01	19.24	0.01
103	2016/10/26	15:38:01	19.31	0.02
104	2016/10/26	15:39:01	19.30	0.03
105	2016/10/26	15:51:01	19.31	0.02
106	2016/10/26	15:52:01	18.95	0.00
107	2016/10/26	15:53:01	19.30	0.03
108	2016/10/26	15:54:01	19.30	0.03
109	2016/10/26	16:04:01	19.30	0.03
110	2016/10/26	16:05:01	19.23	0.03
111	2016/10/26	16:06:01	19.30	0.01
112	2016/10/26	16:07:01	19.30	0.02
113	2016/10/26	16:16:01	19.31	0.03
114	2016/10/26	16:17:01	18.99	0.01
115	2016/10/26	16:18:01	19.29	0.02
116	2016/10/26	16:19:01	19.31	0.04
117	2016/10/26	16:54:01	19.32	0.01
118	2016/10/26	16:55:01	19.25	0.04
119	2016/10/26	16:56:01	19.31	0.03
120	2016/10/26	16:57:01	19.31	0.00
RUN 2 AVERAGES			**19.28**	**0.02**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/26	17:30:01	19.31	0.00
2	2016/10/26	17:31:01	19.23	0.03
3	2016/10/26	17:32:01	19.31	0.03
4	2016/10/26	17:33:01	19.31	0.01
5	2016/10/26	17:42:01	19.31	0.02
6	2016/10/26	17:43:01	19.31	0.03
7	2016/10/26	17:44:01	19.05	0.01
8	2016/10/26	17:45:01	19.31	0.02
9	2016/10/26	17:54:01	19.32	0.03
10	2016/10/26	17:55:01	19.31	0.01
11	2016/10/26	17:56:01	19.11	0.02
12	2016/10/26	17:57:01	19.31	0.04
13	2016/10/26	18:08:01	19.31	0.04
14	2016/10/26	18:09:01	18.95	0.02
15	2016/10/26	18:10:01	19.31	0.02
16	2016/10/26	18:11:01	19.31	0.02
17	2016/10/26	18:21:01	19.31	0.00
18	2016/10/26	18:22:01	18.97	0.02
19	2016/10/26	18:23:01	19.30	0.04
20	2016/10/26	18:24:01	19.31	0.00
21	2016/10/26	18:34:01	19.32	0.03
22	2016/10/26	18:35:01	19.00	0.00
23	2016/10/26	18:36:01	19.29	0.02
24	2016/10/26	18:37:01	19.32	0.04
25	2016/10/26	18:47:01	19.32	0.02
26	2016/10/26	18:48:01	19.02	0.04
27	2016/10/26	18:49:01	19.31	0.02
28	2016/10/26	18:50:01	19.32	0.00
29	2016/10/26	19:24:01	19.33	0.03
30	2016/10/26	19:25:01	19.06	0.02
31	2016/10/26	19:26:01	19.34	0.00
32	2016/10/26	19:27:01	19.33	0.02
33	2016/10/26	19:37:01	19.32	0.00
34	2016/10/26	19:38:01	19.06	0.02
35	2016/10/26	19:39:01	19.33	0.04
36	2016/10/26	19:40:01	19.33	0.02
37	2016/10/26	19:48:01	19.33	0.00
38	2016/10/26	19:49:01	19.03	0.02
39	2016/10/26	19:50:01	19.32	0.05
40	2016/10/26	19:51:01	19.34	0.01
41	2016/10/26	20:06:01	19.34	0.00
42	2016/10/26	20:07:01	19.30	0.02
43	2016/10/26	20:08:01	19.28	0.04
44	2016/10/26	20:09:01	19.34	0.02
45	2016/10/26	20:18:01	19.35	0.02
46	2016/10/26	20:19:01	18.97	0.04
47	2016/10/26	20:20:01	19.32	0.03
48	2016/10/26	20:21:01	19.34	0.00
49	2016/10/26	20:31:01	19.33	0.01
50	2016/10/26	20:32:01	19.09	0.01
51	2016/10/26	20:33:01	19.33	0.04
52	2016/10/26	20:34:01	19.34	0.03
53	2016/10/26	20:42:01	19.32	0.01
54	2016/10/26	20:43:01	19.27	0.01
55	2016/10/26	20:44:01	19.26	0.04
56	2016/10/26	20:45:01	19.32	0.02
57	2016/10/26	21:04:01	19.31	0.01
58	2016/10/26	21:05:01	19.30	0.02
59	2016/10/26	21:06:01	19.24	0.04
60	2016/10/26	21:07:01	19.31	0.02
61	2016/10/26	21:20:01	19.32	0.02
62	2016/10/26	21:21:01	18.85	0.04

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Quench Tower
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/26	21:22:01	19.32	0.04
64	2016/10/26	21:23:01	19.32	0.01
65	2016/10/26	21:33:01	19.32	0.01
66	2016/10/26	21:34:01	18.94	0.01
67	2016/10/26	21:35:01	19.31	0.04
68	2016/10/26	21:36:01	19.31	0.02
69	2016/10/26	22:03:01	19.32	0.01
70	2016/10/26	22:04:01	18.94	0.03
71	2016/10/26	22:05:01	19.32	0.04
72	2016/10/26	22:06:01	19.32	0.00
73	2016/10/26	22:16:01	19.32	0.02
74	2016/10/26	22:17:01	19.17	0.00
75	2016/10/26	22:18:01	19.32	0.02
76	2016/10/26	22:19:01	19.32	0.04
77	2016/10/26	22:28:01	19.32	0.00
78	2016/10/26	22:29:01	18.93	0.02
79	2016/10/26	22:30:01	19.30	0.03
80	2016/10/26	22:31:01	19.33	0.02
81	2016/10/26	22:47:01	19.31	0.02
82	2016/10/26	22:48:01	18.96	0.04
83	2016/10/26	22:49:01	19.31	0.02
84	2016/10/26	22:50:01	19.31	0.01
85	2016/10/26	22:59:01	19.31	0.04
86	2016/10/26	23:00:01	19.22	0.03
87	2016/10/26	23:01:01	19.31	0.01
88	2016/10/26	23:02:01	19.31	0.03
89	2016/10/26	23:37:01	19.31	0.00
90	2016/10/26	23:38:01	19.25	0.03
91	2016/10/26	23:39:01	19.31	0.04
92	2016/10/26	23:40:01	19.30	0.01
93	2016/10/26	23:48:01	19.29	0.00
94	2016/10/26	23:49:01	19.26	0.03
95	2016/10/26	23:50:01	19.30	0.04
96	2016/10/26	23:51:01	19.28	0.01
97	2016/10/27	00:02:01	19.29	0.01
98	2016/10/27	00:03:01	19.00	0.01
99	2016/10/27	00:04:01	19.29	0.03
100	2016/10/27	00:05:01	19.30	0.02
101	2016/10/27	00:29:01	19.30	0.03
102	2016/10/27	00:30:01	19.20	0.03
103	2016/10/27	00:31:01	19.26	0.01
104	2016/10/27	00:32:01	19.31	0.01
105	2016/10/27	00:43:01	19.30	0.02
106	2016/10/27	00:44:01	19.19	0.03
107	2016/10/27	00:45:01	19.30	0.02
108	2016/10/27	00:46:01	19.29	0.00
109	2016/10/27	00:54:01	19.28	0.02
110	2016/10/27	00:55:01	19.04	0.04
111	2016/10/27	00:56:01	19.28	0.02
112	2016/10/27	00:57:01	19.29	0.01
113	2016/10/27	01:07:01	19.28	0.01
114	2016/10/27	01:08:01	19.24	0.01
115	2016/10/27	01:09:01	19.24	0.05
116	2016/10/27	01:10:01	19.28	0.03
117	2016/10/27	01:20:01	19.27	0.03
118	2016/10/27	01:21:01	19.03	0.03
119	2016/10/27	01:22:01	19.28	0.01
120	2016/10/27	01:23:01	19.28	0.01
RUN 3 AVERAGES			**19.25**	**0.02**

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

Client	ArcelorMittal Monessen	**Date**	Oct. 25, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 1
Unit	Quench Tower	**Start Time**	9:10
Operation	Normal	**End Time**	17:32
Tester(s)	JV, JW, TM, TL		

Cal.	LOW		MID		HIGH			Conc.	Tank ID			Response Time (sec)	
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH	Up	Down
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	45	45
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	45	45
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	0.01	-0.25	0.02	-0.20	0.05	20.01	0.02			
	Mid	10.21	10.17	10.14	-0.15	10.12	-0.25	-0.10	20.01	10.13	19.27	19.44	d. vol. %
CO2	Zero		0.05	-0.01	-0.30	-0.01	-0.30	0.00	19.81	-0.01			
	Mid	10.08	9.89	9.94	0.25	9.91	0.10	-0.15	19.81	9.93	0.02	0.03	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Oct. 25-26, 2016
Project No	16-167	**Location**	Baghouse Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Quench Tower	**Start Time**	18:06
Operation	Normal	**End Time**	16:55
Tester(s)	JV, JW, TM, TL		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
LIMITS				40 % to 60 %		100%					

				Initial Values		Final Values							
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.06	0.02	-0.20	0.02	-0.20	0.00	20.01	0.02			
	Mid	10.21	10.17	10.12	-0.25	10.13	-0.20	0.05	20.01	10.13	19.28	19.46	d. vol. %
CO2	Zero		0.05	-0.01	-0.30	-0.04	-0.45	-0.15	19.81	-0.03			
	Mid	10.08	9.89	9.91	0.10	9.92	0.15	0.05	19.81	9.92	0.02	0.05	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Oct. 26-27, 2016
Project No	16-167	**Location**	Baghouse Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	17:28
Operation	Normal	**End Time**	1:23
Tester(s)	JV, JW, TM, TL		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414
LIMITS				40 % to 60 %		100%					

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.00	0.02	0.10	0.03	0.15	0.05	20.01	0.03			
	Mid	10.21	10.17	10.13	-0.20	10.15	-0.10	0.10	20.01	10.14	19.25	19.41	d. vol. %
CO2	Zero		0.20	-0.04	-1.21	-0.04	-1.21	0.00	19.81	-0.04			
	Mid	10.08	9.89	9.92	0.15	9.93	0.20	0.05	19.81	9.93	0.02	0.06	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.0	0.00					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.2	1.01					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen	Test Date:	Oct. 25, 2016
Project No.:	16-167	Test Location:	Top of Quench Tower
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Quench Tower	Test Start Time:	9:10 AM
Unit Operation:	Normal	Test Finish Time:	5:32 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

Control Box:	1936	
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O
Meter Calibration Factor (Yd)	0.988	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.48	in. Hg
Stack Static Pressure (Pg)	0.10	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.300	inches
O2	19.44	% dv
CO2	0.03	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Formaldehyde Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	65.1	F
Stack Temperature (Tsavg)	161.3	F
Orifice Pressure Drop (dHavg)	0.460	in. H_2O
GasVelocity Head (dP)' "avg	0.2653	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

Total Test Time	8.37	hours
# of quenches	48	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	80.53	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	183.0	g
Water Vapor in Silica Gel (Vwsg(std))	8.628	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	8.628	scf
Volume Dry Gas Metered (Vm)	44.821	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	43.907	dscf
Volume Dry Gas Metered (Vm(m^3))	1.269	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.243	dscm
Stack Absolute Pressure (Ps)	29.49	in. Hg
Stack Absolute Temperature (Tsavg)	621.0	R
H2O Vapor Pressure @ avg Stack Temp.	9.98	in. Hg
H2O in the gas at saturation (Bws)	0.3383	vol. fraction
H2O in the gas from test data (Bws)	0.1642	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1642	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.78	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.01	lb/lb-mole
Gas Velocity (Vs)	16.83	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft"
Actual Gas Flowrate	908,708	acfm
Standard Gas Flowrate	761,040	scfm
Dry Standard Gas Flowrate	636,047	dscfm
Actual Gas Flowrate	25,732	acm/min
Standard Gas Flowrate	21,550	scm/min
Dry Standard Gas Flowrate	18,011	dscm/min
Area Nozzle (An)	0.000491	ft^2
Percent of Isokinetic Sampling (I)	105.53	%

Formaldehyde

Front Half Gain	<	12.00	(µg)
Back Half Gain			(µg)
Emission Mass	<	0.0120	(mg)
Emission Concentration	<	0.0097	(mg/DSCM)
Emission Rate	<	NA	(lb/quench)
Emission Rate	<	NA	(lb/hr)

ArcelorMittal Monessen **Run 1** **F or C?**
Quench Tower **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	0.013	0.114	0.54	120	58	58
A-2	0.028	0.167	1.20	128	59	58
A-3	0.060	0.245	0.33	119	60	59
A-4	0.073	0.270	0.40	125	60	59
A-5	0.075	0.274	0.41	131	62	62
A-6	0.068	0.261	0.37	129	63	62
B-1	0.082	0.286	0.45	172	63	63
B-2	0.085	0.292	0.47	163	64	63
B-3	0.097	0.311	0.53	154	65	64
B-4	0.083	0.288	0.46	160	65	64
B-5	0.085	0.292	0.47	172	67	65
B-6	0.073	0.270	0.40	168	68	66
C-1	0.078	0.279	0.43	165	68	67
C-2	0.092	0.303	0.51	183	68	67
C-3	0.083	0.288	0.46	188	69	67
C-4	0.080	0.283	0.44	181	68	67
C-5	0.070	0.265	0.39	172	68	68
C-6	0.074	0.272	0.41	179	68	68
D-1	0.068	0.261	0.37	172	69	68
D-2	0.071	0.266	0.39	178	68	68
D-3	0.080	0.283	0.44	190	68	67
D-4	0.071	0.266	0.39	174	68	67
D-5	0.076	0.276	0.42	176	68	67
D-6	0.065	0.255	0.36	173	69	67
Average	0.07	0.2653	0.46	161.3		65.1

Initial volume	63.637	ft^3	Initial volume	0.000	liters
Final volume	108.458	ft^3	Final volume	0.000	liters
Total metered	44.821	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	875.0	711.3	163.7			0.0
2	711.9	698.9	13.0			0.0
3	621.1	621.3	-0.2			0.0
4	787.5	781.0	6.5			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	2995.5	2812.5	183.0	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:	Oct. 25-26, 2016
Project No.:	16-167	Test Location:	Baghouse Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Quench Tower	Test Start Time:	6:06 PM
Unit Operation:	Normal	Test Finish Time:	4:55 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:	1936	
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O
Meter Calibration Factor (Yd)	0.988	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.49	in. Hg
Stack Static Pressure (Pg)	0.10	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.300	inches
O2	19.46	% dv
CO2	0.05	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Formaldehyde Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	63.5	F
Stack Temperature (Tsavg)	177.1	F
Orifice Pressure Drop (dHavg)	0.435	in. H_2O
GasVelocity Head (dP)'''avg	0.2892	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
Total Test Time	22.82	hours
# of quenches	48	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	80.49	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	119.3	g
Water Vapor in Silica Gel (Vwsg(std))	5.625	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	5.625	scf
Volume Dry Gas Metered (Vm)	44.978	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	44.210	dscf
Volume Dry Gas Metered (Vm(m^3))	1.274	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.252	dscm
Stack Absolute Pressure (Ps)	29.50	in. Hg
Stack Absolute Temperature (Tsavg)	636.8	R
H2O Vapor Pressure @ avg Stack Temp.	14.35	in. Hg
H2O in the gas at saturation (Bws)	0.4863	vol. fraction
H2O in the gas from test data (Bws)	0.1129	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1129	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.79	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.57	lb/lb-mole
Gas Velocity (Vs)	18.38	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	992,640	acfm
Standard Gas Flowrate	811,056	scfm
Dry Standard Gas Flowrate	719,510	dscfm
Actual Gas Flowrate	28,109	acm/min
Standard Gas Flowrate	22,967	scm/min
Dry Standard Gas Flowrate	20,374	dscm/min
Area Nozzle (An)	0.000491	ft^2
Percent of Isokinetic Sampling (I)	93.94	%

Formaldehyde

Front Half Gain	34.00	(µg)
Back Half Gain		(µg)
Emission Mass	0.0340	(mg)
Emission Concentration	0.0272	(mg/DSCM)
Emission Rate	NA	(lb/quench)
Emission Rate	NA	(lb/hr)

ArcelorMittal Monessen Run 2
Quench Tower

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	0.062	0.249	0.32	163	66	67
A-2	0.068	0.261	0.35	168	66	66
A-3	0.079	0.281	0.41	183	68	66
A-4	0.098	0.313	0.50	176	62	63
A-5	0.095	0.308	0.49	175	62	63
A-6	0.080	0.283	0.42	180	62	64
B-1	0.090	0.300	0.47	180	62	64
B-2	0.089	0.298	0.46	185	62	67
B-3	0.070	0.265	0.36	173	62	66
B-4	0.095	0.308	0.49	179	62	62
B-5	0.082	0.286	0.43	184	54	53
B-6	0.080	0.283	0.42	180	57	56
C-1	0.086	0.293	0.45	176	59	58
C-2	0.081	0.285	0.42	179	59	58
C-3	0.095	0.308	0.49	182	62	61
C-4	0.089	0.298	0.46	172	64	63
C-5	0.084	0.290	0.44	168	66	65
C-6	0.078	0.279	0.41	182	67	65
D-1	0.072	0.268	0.37	174	67	66
D-2	0.080	0.283	0.42	167	66	65
D-3	0.094	0.307	0.49	181	66	66
D-4	0.099	0.315	0.51	177	67	66
D-5	0.083	0.288	0.43	184	67	66
D-6	0.085	0.292	0.44	182	68	67
Average	0.08	0.289	0.44	177.1		63.5

Initial volume	109.702	ft^3	Initial volume	0.000	liters
Final volume	154.680	ft^3	Final volume	0.000	liters
Total metered	44.978	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	899.9	796.6	103.3			0.0
2	692.0	681.9	10.1			0.0
3	599.1	599.2	-0.1			0.0
4	813.6	807.6	6.0			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	3004.6	2885.3	119.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal Monessen	Test Date:	Oct. 26-27, 2016
Project No.:	16-167	Test Location:	Baghouse Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Quench Tower	Test Start Time:	5:28 PM
Unit Operation:	Normal	Test Finish Time:	1:23 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:	1936	
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O
Meter Calibration Factor (Yd)	0.988	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.26	in. Hg
Stack Static Pressure (Pg)	0.12	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter 0 if circular stack)	216.0	inches
Nozzle Diameter (Dn)	0.300	inches
O2	19.41	% dv
CO2	0.06	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Formaldehyde Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	67.0	F
Stack Temperature (Tsavg)	173.5	F
Orifice Pressure Drop (dHavg)	0.425	in. H_2O
GasVelocity Head (dP)^^avg	0.2857	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
Total Test Time	7.92	hours
# of quenches	48	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	80.53	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	244.4	g
Water Vapor in Silica Gel (Vwsg(std))	11.523	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	11.523	scf
Volume Dry Gas Metered (Vm)	43.954	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	42.579	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	1.245	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	1.206	dscm
Stack Absolute Pressure (Ps)	29.27	in. Hg
Stack Absolute Temperature (Tsavg)	633.2	R
H2O Vapor Pressure @ avg Stack Temp.	13.23	in. Hg
H2O in the gas at saturation (Bws)	0.4521	vol. fraction
H2O in the gas from test data (Bws)	0.2130	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.2130	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.79	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.49	lb/lb-mole
Gas Velocity (Vs)	18.54	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft²
Actual Gas Flowrate	1,001,390	acfm
Standard Gas Flowrate	816,459	scfm
Dry Standard Gas Flowrate	642,560	dscfm
Actual Gas Flowrate	28,356	acm/min
Standard Gas Flowrate	23,120	scm/min
Dry Standard Gas Flowrate	18,195	dscm/min
Area Nozzle (An)	0.000491	ft^2
Percent of Isokinetic Sampling (I)	101.31	%

Formaldehyde

Front Half Gain	<	11.00	(µg)
Back Half Gain			(µg)
Emission Mass	<	0.0110	(mg)
Emission Concentration	<	0.0091	(mg/DSCM)
Emission Rate	<	NA	(lb/quench)
Emission Rate	<	NA	(lb/hr)

ArcelorMittal Monessen **Run 3** **F or C?**
Quench Tower **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	0.083	0.288	0.43	179	67	67
A-2	0.081	0.285	0.42	174	69	67
A-3	0.077	0.277	0.40	183	67	67
A-4	0.082	0.286	0.43	181	67	67
A-5	0.072	0.268	0.37	184	66	66
A-6	0.079	0.281	0.41	178	66	66
B-1	0.082	0.286	0.43	170	66	66
B-2	0.081	0.285	0.42	170	67	67
B-3	0.072	0.268	0.37	178	67	67
B-4	0.089	0.298	0.46	178	66	66
B-5	0.092	0.303	0.48	172	66	67
B-6	0.082	0.286	0.43	180	66	66
C-1	0.081	0.285	0.42	172	66	66
C-2	0.080	0.283	0.42	178	67	68
C-3	0.089	0.298	0.46	168	66	67
C-4	0.072	0.268	0.37	167	66	67
C-5	0.090	0.300	0.47	169	66	67
C-6	0.090	0.300	0.47	165	67	68
D-1	0.081	0.285	0.42	162	67	68
D-2	0.079	0.281	0.41	168	68	68
D-3	0.082	0.286	0.43	165	68	68
D-4	0.089	0.298	0.46	170	68	68
D-5	0.079	0.281	0.41	178	68	68
D-6	0.077	0.277	0.40	175	68	68
Average	0.08	0.2857	0.42	173.5		67.0

Initial volume	154.808	ft^3	Initial volume	0.000	liters
Final volume	198.762	ft^3	Final volume	0.000	liters
Total metered	43.954	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	899.9	674.8	225.1			0.0
2	677.1	668.9	8.2			0.0
3	620.0	619.9	0.1			0.0
4	798.5	787.5	11.0			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	2995.5	2751.1	244.4	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- Vi)

MONTROSE METHOD 316 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 316 Formaldehyde	Meter ΔH :	1.830	Start Time:	09:10
Date:	10/25/16	Run Number:	1	Meter Correction (γ):	0.998	Stop Time:	17:32
Plant:	Monessen, PA	Nozzle Diameter (inches):	~~0.512~~ 3/8" 0.300	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	0.1	Control Box ID:	MB 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.52	Assumed Moisture (%):	20%	Pitot ID:	9-6
Project Number:	106377 (16-167)	Ambient Temp (°F):	43	Umbilical Length (Feet):	200'	Filter ID:	NA
Test Crew:	JV JW TM CB	Initial K-factor	~~44.7~~ 5.5			Stack Diameter (inches):	600 x 216 RECT

(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
		63.637 RCD	.16									
A-1	0:05:00	65.38 10-25	0.~~013~~ .013	.54	2	120	247		54	58	58	09:10 9:21
A-2	0:10:00	67.52	0.028	1.2	2	128	249		52	59	58	9:34
A-3	0:15:00	69.62	0.060	.33	2	119	247		50	60	59	9:48
A-4	0:20:00	71.35	.0735	.40	2	125	248		47	60	59	10:14
A-5	0:25:00	73.16	.075	.41	2	131	246		47	62	62	10:53
A-6	0:30:00	74.93	.068	.37	2	129	249		53	63	62	11:05 11:19
B-1	0:35:00	76.73	.082	.45	2	172	246		49	63	63	11:32
B-2	0:40:00	78.66	.085	.47	2	163	249		49	64	63	11:47
B-3	0:45:00	80.64	.097	.53	2	154	250		48	65	64	12:14 12:28
B-4	0:50:00	82.57	.083	.46	2	160	245		49	65	64	12:44
B-5	0:55:00	84.53	.085	.47	2	172	248		45	67	65	12:57
B-6	1:00:00	86.32	.073	.40	2	168	250		46	68	66	13:33 13:44
C-1	1:05:00	88.22	.078	.43	2	165	245		46	68	67	13:55
C-2	1:10:00	90.24	.092	.51	2 RCD 10-25-16	~~154~~ 183	248		46	68	67	14:07
C-3	1:15:00	92.18	.083	.46	2	188	252		49	69	67	14:18
C-4	1:20:00	94.07	.080	.44	2	181	248		48	68	67	14:36
C-5	1:25:00	95.84	.070	.39	2	172	247		49	68	68	14:52 15:07
C-6	1:30:00	97.65	.074	.41	2	179	246		50	68	68	15:11
D-1	1:35:00	99.41	.068	.37	2	172	249		49	69	68	15:53 16:17
D-2	1:40:00	101.17	.071	.39	2	178	243		57	68	68	16:32
D-3	1:45:00	103.05	.080	.44	2	190	247		51	68	67	16:46 17:00
D-4	1:50:00	105.23	.071	.39	2	~~174~~	249		51	68	67	17:00
D-5	1:55:00	106.69	.076	.42	2	176	249		50	68	67	17:14
D-6	2:00:00	108.458	.065	.36	2	173	246		49	69	67	17:28 (17:32 Stop)

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.002
Check	Final	5	0.000
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

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

Fyrite Kit ID: NA Fyrite O_2 Check NA %

Balance ID: BAL 017

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

Imp	Contents	Final	Initial	Difference
1	H_2O (g)*	875.0	711.3	
2	H_2O (g)*	711.9	698.9	
3	Empty (g)	621.1	621.3	
4	Silica (g)	787.5	781.0	

* Type 1 High Purity HPLC Water

MONTROSE METHOD 316 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 316 Formaldehyde	Meter ΔH :	1.830	Start Time:	18:06
Date:	10/25/16	Run Number:	2	Meter Correction (γ):	0.998	Stop Time:	16:55 10/26/16
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.300	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	0.1	Control Box ID:	MB 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.49	Assumed Moisture (%):	20%	Pitot ID:	9-6
Project Number:	106377 (16-167)	Ambient Temp (°F):	53	Umbilical Length (Feet):	200'	Filter ID:	NA
Test Crew:	JV JW TM CB	Initial K-factor	5.2			Stack Diameter (inches):	600 x 216 Rect

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 109.702	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	0:05:00	111.35	.062	.32	1	163	248	NA	51	66	67	18:06 1820
A-2	0:10:00	113.05	.068	.35	1	168	248		48	66	66	1832
A-3	0:15:00	114.87	.079	.41	1	183	248		47	68	66	1906
A-4	0:20:00	116.82	.096	.50	1	176	248		45	62	63	1919 1932
A-5	0:25:00	119.213	.095	0.49	1	175	248		45	62	63	1951
A-6	0:30:00	120.850	0.080	0.42	1	180	247		44	62	64	2004
B-1	0:35:00	122.638	0.090	0.47	1	180	248		44	62	64	2018
B-2	0:40:00	124.697	0.089	0.46	1	185	248		44	62	67	2030
B-3	0:45:00	126.555	0.070	0.36	1	173	248		46	62	65	2052 2122
B-4	0:50:00	128.36	0.095	0.49	1	179	248		47	62	62	started back up @ 12:22 10/26/16
B-5	0:55:00	130.20	.082	.43	1	184	248		46	54	53	1248
B-6	1:00:00	132.046	.080	.42	1	180	249		47	57	56	1257 1309
C-1	1:05:00	133.93	.086	.45	1	176	246		44	59	58	1322
C-2	1:10:00	135.78	.081	.42	1	179	247		43	59	58	1335
C-3	1:15:00	137.54	.095	.49	1	182	251		45	62	61	1347
C-4	1:20:00	139.654	.089	.46	1	172	250		48	64	63	1358
C-5	1:25:00	141.51	.084	.44	1	168	248		46	66	65	1417 1428
C-6	1:30:00	143.34	.078	.41	1	182	245		45	67	65	1441
D-1	1:35:00	145.14	.072	.37	1	174	246		45	67	66	1453
D-2	1:40:00	146.93	.080	.42	1	167	249		44	66	65	1505 1534
D-3	1:45:00	148.91	.094	.49	1	181	247		44	66	66	1549
D-4	1:50:00	150.95	.099	.51	1	177	248		45	67	66	1602
D-5	1:55:00	152.81	.083	.43	1	184	249		45	67	66	1614
D-6	2:00:00	154.680	.085	.44	1	182	248		45	68	67	1651

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.003
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: BAL-017

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

Imp	Contents	Final	Initial	Difference
1	H_2O (g)*	899.9	796.6	103.3
2	H_2O (g)*	692.0	681.9	
3	Empty (g)	599.1	599.2	
4	Silica (g)	813.6	807.6	

* Type 1 High Purity HPLC Water

MONTROSE METHOD 316 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 316 Formaldehyde	Meter ΔH :	1.830	Start Time:	17:28
Date:	10/26/16	Run Number:	3	Meter Correction (γ):	0.998	Stop Time:	1:23
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.300	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Quench Tower Outlet	Static Press (in. H_2O):	0.1	Control Box ID:	MB 1936	Probe ID:	9-6
		Baro. Pres. (in. Hg):	29.48	Assumed Moisture (%):	20%	Pitot ID:	9-6
Project Number:	106377 (16-167)	Ambient Temp (°F):	55	Umbilical Length (Feet):	200'	Filter ID:	NA
Test Crew:	JV JW TM CB	Initial K-factor	5.2			Stack Diameter (inches):	680 x 216 ~~1805~~

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 154.808	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	0:05:00	156.79	.083	.43	1	179	250	NA	46	67	67	1728 1740
A-2	0:10:00	158.53	.081	.42	1	174	247		46	69	67	1753
A-3	0:15:00	160.34	.077	.40	1	183	249		46	67	67	1806
A-4	0:20:00	162.243	.082	.43	1	181	246		45	67	67	1828 1832
A-5	0:25:00	163.97	.072	.37	1	184	247		47	66	66	1845
A-6	0:30:00	165.787	.079	.41	1	178	246		46	66	66	1927
B-1	0:35:00	167.592	0.082	0.43	1	170	247		46	66	66	1938
B-2	0:40:00	169.415	0.081	0.42	1	170	247		46	67	67	1948
B-3	0:45:00	171.203	0.072	0.37	1	178	247		46	67	67	2000 2007
B-4	0:50:00	173.008	0.089	0.46	1	178	248		47	66	66	2029
B-5	0:55:00	174.938	0.092	0.48	1	172	248		47	66	67	2040
B-6	1:00:00	176.555	0.082	0.43	1	180	248		46	66	66	2162 2169
C-1	1:05:00	178.293	0.081	0.42	1	172	248		46	66	66	2332
C-2	1:10:00	180.111	0.080	0.42	1	176	248		46	67	68	2200
C-3	1:15:00	181.963	0.089	0.46	1	168	248		47	66	67	2247
C-4	1:20:00	183.821	0.072	0.37	1	167	248		48	66	67	2256
C-5	1:25:00	185.630	0.090	0.47	1	169	248		48	66	67	2247 2258
C-6	1:30:00	187.481	0.090	0.47	1	165	249		47	67	68	2335 1443 Stop
D-1	1:35:00	189.500	0.081	0.42	1	162	247		49	67	68	2347 ~~2359~~ 1456 Stop
D-2	1:40:00	191.278	0.079	0.41	1	168	248		48	68	68	2359 0027
D-3	1:45:00	193.095	0.082	0.43	1	165	248		49	68	68	0038
D-4	1:50:00	195.202	0.089	0.46	1	170	248		50	68	68	0053
D-5	1:55:00	197.183	0.079	0.41	1	178	247		50	68	68	0105
D-6	2:00:00	198.762	0.77	0.40	1	175	248	✓	50	68	68	0110

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	10	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	M	S
O_2 (%)				
Fyrite Kit ID:	NA	Fyrite O_2 Check		NA %
Balance ID:	BAL-017			
Ref. Weight (200g):	NA	Tolerance = +/- 0.5 g		
Ref. Weight (500g):	520.0	Tolerance = +/- 0.5 g		

Imp	Contents	~~Final~~ JW	Initial	Difference	Final
1	H_2O (g)* JW	~~841.9~~	674.8	~~225.1~~	899.9
2	H_2O (g) ~~677.1~~	~~642.0~~	668.9	+ JW	677.1
3	Empty (g) ~~620.0~~	~~544.1~~	619.9		620.0
4	Silica (g)	798.5	787.5		798.5

* Type 1 High Purity HPLC Water

Methods 0031

Client:	ArcelorMittal Monessen		Test Date:	Oct. 25, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Quench Tower		Test Start Time:	9:10 AM	
Unit Operation:	Normal		Test Finish Time:	5:32 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

Control Box:	1936	
Meter $DH_@$ (0.75 scfm)	1.830	in. H_2O
Meter Calibration Factor (Yd)	0.998	
Barometric Pressure (Pbar)	29.48	in. Hg
Stack Static Pressure (Pg)	0.10	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter NA if circular)	216.0	inches
O2 (taken from CEMs spreadsheet)	19.44	% dv
CO2 (taken from CEMs spreadsheet)	0.03	% 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, Select VOC's	
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)	65.1	F
Stack Temperature (Tsavg)	161.3	F
Orifice Pressure Drop (dHavg)	0.460	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2653	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
Total Test Time	8.37	hours
# of quenches	24	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	80.53	% dv
Water Collected (V_f - V_i)	NA	ml
Water Vapor Condensed (Vwc(std))	NA	scf
Water Collected (W_f - W_i)	NA	g
Water Vapor in Silica Gel (Vwsg(std))	NA	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	NA	scf
Volume Dry Gas Metered (Vm)	NA	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	NA	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	NA	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	NA	dscm
Stack Absolute Pressure (Ps)	29.49	in. Hg
Stack Absolute Temperature (Tsavg)	621.0	R
H2O Vapor Pressure @ avg Stack Temp.	9.98	in. Hg
H2O in the gas at saturation (Bws)	0.3383	vol. fraction
H2O in the gas from test data (Bws)	0.1629	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1629	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.78	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.03	lb/lb-mole
Gas Velocity (Vs)	16.82	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	908,458	acfm
Standard Gas Flowrate	760,831	scfm
Dry Standard Gas Flowrate	636,920	dscfm
Actual Gas Flowrate	25,725	acm/min
Standard Gas Flowrate	21,544	scm/min
Dry Standard Gas Flowrate	18,036	dscm/min

Acrylonitrile (107-13-1)			**Ethylbenzene (100-41-4)**		
Emission Mass	<	0.03	µg	0.05	µg
Molecular Weight		53.06	lb/lb-mole	106.17	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM	0.00	mg/DSCM
Emission Concentration	<	2.55E-11	lb/dscf	4.58E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}	0.0002	ppm_{dv}
Emission Rate	<	NA	lb/hr	NA	lb/hr
Benzene				**Iodomethane (74-88-4)**	
Emission Mass		1.90	µg	< 0.02	µg
Molecular Weight		78.11	lb/lb-mole	141.94	lb/lb-mole
Emission Concentration		0.03	mg/DSCM	< 0.00	mg/DSCM
Emission Concentration		1.93E-09	lb/dscf	< 1.53E-11	lb/dscf
Emission Concentration		0.0095	ppm_{dv}	< 0.0000	ppm_{dv}
Emission Rate		NA	lb/hr	< NA	lb/hr
Bromoform (75-25-2)				**Methylene chloride (75-09-2)**	
Emission Mass	<	0.01	µg	< 0.03	µg
Molecular Weight		252.731	lb/lb-mole	84.93	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM	< 0.00	mg/DSCM
Emission Concentration	<	1.43E-11	lb/dscf	< 2.55E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}	< 0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr	< NA	lb/hr
Bromomethane (74-83-9)				**Styrene (100-42-5)**	
Emission Mass	<	0.02	µg	0.11	µg
Molecular Weight		252.731	lb/lb-mole	104.15	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM	0.00	mg/DSCM
Emission Concentration	<	1.53E-11	lb/dscf	1.14E-10	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}	0.0004	ppm_{dv}
Emission Rate	<	NA	lb/hr	NA	lb/hr
Carbon disulfide (75-15-0)				**1,1,2,2-Tetrachloroethane (79-34-5)**	
Emission Mass		1.45	µg	< 0.01	µg
Molecular Weight		76.139	lb/lb-mole	167.848	lb/lb-mole
Emission Concentration		0.02	mg/DSCM	< 0.00	mg/DSCM
Emission Concentration		1.47E-09	lb/dscf	< 1.43E-11	lb/dscf
Emission Concentration		0.0075	ppm_{dv}	< 0.0000	ppm_{dv}
Emission Rate		NA	lb/hr	< NA	lb/hr

ArcelorMittal Monessen Run 1
Quench Tower

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

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)	Sample Train Temp Side A
A-1	0.013	0.114	0.54	120	58	58	9
A-2	0.028	0.167	1.20	128	59	58	10
A-3	0.060	0.245	0.33	119	60	59	10
A-4	0.073	0.270	0.40	125	60	59	10
A-5	0.075	0.274	0.41	131	62	62	10
A-6	0.068	0.261	0.37	129	63	62	11
B-1	0.082	0.286	0.45	172	63	63	11
B-2	0.085	0.292	0.47	163	64	63	11
B-3	0.097	0.311	0.53	154	65	64	11
B-4	0.083	0.288	0.46	160	65	64	12
B-5	0.085	0.292	0.47	172	67	65	13
B-6	0.073	0.270	0.40	168	68	66	13
C-1	0.078	0.279	0.43	165	68	67	14
C-2	0.092	0.303	0.51	183	68	67	14
C-3	0.083	0.288	0.46	188	69	67	15
C-4	0.080	0.283	0.44	181	68	67	15
C-5	0.070	0.265	0.39	172	68	68	15
C-6	0.074	0.272	0.41	179	68	68	14
D-1	0.068	0.261	0.37	172	69	68	14
D-2	0.071	0.266	0.39	178	68	68	14
D-3	0.080	0.283	0.44	190	68	67	14
D-4	0.071	0.266	0.39	174	68	67	14
D-5	0.076	0.276	0.42	176	68	67	14
D-6	0.065	0.255	0.36	173	69	67	14
							14
							14
							14
							14
							14
							14
Average	0.0721	0.2653	0.46	161.3		65.1	12.9

1st Set of Tubes

Initial volume	0.000	liters
Final volume	19.945	liters
Total metered	19.945	dry actual liters

Leak Check Volume 0.000 dry actual liters

2nd Set of Tubes

Initial volume	0.000	liters
Final volume	19.980	liters
Total metered	19.980	dry actual liters

Leak Check Volume 0.000 dry actual liters

3rd Set of Tubes

Initial volume	0.000	liters
Final volume	19.950	liters
Total metered	19.950	dry actual liters

Sample Train Volume	59.875	(liters)
Unspiked Train Meter ID	VOST-1	
Meter Correction Factor	1.008	
VOST meter Temp	12.9	(def C)
VOST meter Temp	55.2	(def F)
Corrected Volume	60.924	(liters, dry standard)
Corrected Volume	0.061	(dscm)

Carbon tetrachloride (56-23-5)

Emission Mass	<	0.02	µg
Molecular Weight		153.82	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.63E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chlorobenzene (108-90-7)

Emission Mass	<	0.01	µg
Molecular Weight		112.56	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloroethane (75-00-3)

Emission Mass	<	0.01	µg
Molecular Weight		64.51	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	9.16E-12	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloroform (67-66-3)

Emission Mass	<	0.01	µg
Molecular Weight		119.38	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloromethane (74-87-3)

Emission Mass		0.04	µg
Molecular Weight		50.488	lb/lb-mole
Emission Concentration		0.00	mg/DSCM
Emission Concentration		3.87E-11	lb/dscf
Emission Concentration		0.0003	ppm_{dv}
Emission Rate		NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		98.95	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	7.13E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		96.94	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		112.98	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Tetrachloroethene (127-18-4)

Emission Mass	<	0.02	µg
Molecular Weight		165.82	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.83E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Toluene (108-88-3)

Emission Mass		0.45	µg
Molecular Weight		92.14	lb/lb-mole
Emission Concentration		0.0	mg/DSCM
Emission Concentration		4.53E-10	lb/dscf
Emission Concentration		0.00	ppm_{dv}
Emission Rate		NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.43E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.02	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.63E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Trichloroethene (79-01-6)

Emission Mass	<	0.01	µg
Molecular Weight		131.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Vinyl chloride (75-01-4)

Emission Mass	<	0.01	µg
Molecular Weight		62.498	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.32E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Xylenes (total) (1330-20-7)

Emission Mass		0.42	µg
Molecular Weight		106.16	lb/lb-mole
Emission Concentration		0.01	mg/DSCM
Emission Concentration		4.26E-10	lb/dscf
Emission Concentration		0.0015	ppm_{dv}
Emission Rate		NA	lb/hr

Client:	ArcelorMittal Monessen		Test Date:	Oct. 25-26, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Quench Tower		Test Start Time:	6:06 PM	
Unit Operation:	Normal		Test Finish Time:	4:55 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:	1936	
Meter $DH_@$ (0.75 scfm)	1.83	in. H_2O
Meter Calibration Factor (Yd)	0.998	
Barometric Pressure (Pbar)	29.49	in. Hg
Stack Static Pressure (Pg)	0.10	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600	inches
Stack Width (enter NA if circular)	216	inches
O2 (taken from CEMs spreadsheet)	19.46	% dv
CO2 (taken from CEMs spreadsheet)	0.05	% dv
Product Rate (enter NA if not needed)	NA	ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Flow, Moisture, Phenol	
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	63.5	F
Stack Temperature (Tsavg)	177.1	F
Orifice Pressure Drop (dHavg)	0.435	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2892	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
Total Test Time	22.82	hours
# of quenches	24	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	80.49	% dv
Water Collected (V_f - V_i)	NA	ml
Water Vapor Condensed (Vwc(std))	NA	scf
Water Collected (W_f - W_i)	NA	g
Water Vapor in Silica Gel (Vwsg(std))	NA	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	NA	scf
Volume Dry Gas Metered (Vm)	NA	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	NA	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	NA	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	NA	dscm
Stack Absolute Pressure (Ps)	29.50	in. Hg
Stack Absolute Temperature (Tsavg)	636.8	R
H2O Vapor Pressure @ avg Stack Temp.	14.35	in. Hg
H2O in the gas at saturation (Bws)	0.4863	vol. fraction
H2O in the gas from test data (Bws)	0.1116	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1116	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.79	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.58	lb/lb-mole
Gas Velocity (Vs)	18.38	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	992,397	acfm
Standard Gas Flowrate	810,857	scfm
Dry Standard Gas Flowrate	720,351	dscfm
Actual Gas Flowrate	28,102	acm/min
Standard Gas Flowrate	22,961	scm/min
Dry Standard Gas Flowrate	20,398	dscm/min

Acrylonitrile (107-13-1)				**Ethylbenzene (100-41-4)**			
Emission Mass	<	0.03	µg	Emission Mass	<	0.03	µg
Molecular Weight		53.06	lb/lb-mole	Molecular Weight		106.17	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM	Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	2.38E-11	lb/dscf	Emission Concentration	<	2.45E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}	Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr	Emission Rate	<	NA	lb/hr
Benzene				**Iodomethane (74-88-4)**			
Emission Mass		0.27	µg	Emission Mass	<	0.02	µg
Molecular Weight		78.11	lb/lb-mole	Molecular Weight		141.94	lb/lb-mole
Emission Concentration		0.00	mg/DSCM	Emission Concentration	<	0.00	mg/DSCM
Emission Concentration		2.61E-10	lb/dscf	Emission Concentration	<	1.43E-11	lb/dscf
Emission Concentration		0.0013	ppm_{dv}	Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate		NA	lb/hr	Emission Rate	<	NA	lb/hr
Bromoform (75-25-2)				**Methylene chloride (75-09-2)**			
Emission Mass	<	0.01	µg	Emission Mass	<	0.04	µg
Molecular Weight		252.731	lb/lb-mole	Molecular Weight		84.93	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM	Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.33E-11	lb/dscf	Emission Concentration	<	3.69E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}	Emission Concentration	<	0.0002	ppm_{dv}
Emission Rate	<	NA	lb/hr	Emission Rate	<	NA	lb/hr
Bromomethane (74-83-9)				**Styrene (100-42-5)**			
Emission Mass	<	0.02	µg	Emission Mass	<	0.02	µg
Molecular Weight		252.731	lb/lb-mole	Molecular Weight		104.15	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM	Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.43E-11	lb/dscf	Emission Concentration	<	2.26E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}	Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr	Emission Rate	<	NA	lb/hr
Carbon disulfide (75-15-0)				**1,1,2,2-Tetrachloroethane (79-34-5)**			
Emission Mass	<	0.76	µg	Emission Mass	<	0.01	µg
Molecular Weight		76.139	lb/lb-mole	Molecular Weight		167.848	lb/lb-mole
Emission Concentration	<	0.01	mg/DSCM	Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	7.25E-10	lb/dscf	Emission Concentration	<	1.33E-11	lb/dscf
Emission Concentration	<	0.0037	ppm_{dv}	Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr	Emission Rate	<	NA	lb/hr

ArcelorMittal Monessen **Run 2** **F or C?**
Quench Tower **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)	Sample Train Temp Side A
A-1	0.062	0.249	0.32	163	66	67	18
A-2	0.068	0.261	0.35	168	66	66	19
A-3	0.079	0.281	0.41	183	68	66	18
A-4	0.098	0.313	0.50	176	62	63	18
A-5	0.095	0.308	0.49	175	62	63	18
A-6	0.080	0.283	0.42	180	62	64	18
B-1	0.090	0.300	0.47	180	62	64	19
B-2	0.089	0.298	0.46	185	62	67	19
B-3	0.070	0.265	0.36	173	62	66	18
B-4	0.095	0.308	0.49	179	62	62	18
B-5	0.082	0.286	0.43	184	54	53	18
B-6	0.080	0.283	0.42	180	57	56	18
C-1	0.086	0.293	0.45	176	59	58	19
C-2	0.081	0.285	0.42	179	59	58	19
C-3	0.095	0.308	0.49	182	62	61	19
C-4	0.089	0.298	0.46	172	64	63	19
C-5	0.084	0.290	0.44	168	66	65	18
C-6	0.078	0.279	0.41	182	67	65	18
D-1	0.072	0.268	0.37	174	67	66	18
D-2	0.080	0.283	0.42	167	66	65	18
D-3	0.094	0.307	0.49	181	66	66	18
D-4	0.099	0.315	0.51	177	67	66	18
D-5	0.083	0.288	0.43	184	67	66	19
D-6	0.085	0.292	0.44	182	68	67	19
Average	0.0839	0.2892	0.44	177.1		63.5	18.4

1st Set of Tubes

Initial volume	0.000	liters
Final volume	20.034	liters
Total metered	20.034	dry actual liters

Leak Check Volume 0.000 dry actual liters

2nd Set of Tubes

Initial volume	0.000	liters
Final volume	20.013	liters
Total metered	20.013	dry actual liters

Leak Check Volume 0.000 dry actual liters

3rd Set of Tubes

Initial volume	0.000	liters
Final volume	20.011	liters
Total metered	20.011	dry actual liters

Sample Train Volume	60.058	(liters)
Unspiked Train Meter ID	VOST-1	
Meter Correction Factor	1.008	
VOST meter Temp	18.4	(def C)
VOST meter Temp	65.1	(def F)
Corrected Volume	59.977	(liters, dry standard)
Corrected Volume	0.060	(dscm)

Carbon tetrachloride (56-23-5)

Emission Mass	<	0.02	µg
Molecular Weight		153.82	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.53E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chlorobenzene (108-90-7)

Emission Mass	<	0.01	µg
Molecular Weight		112.56	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloroethane (75-00-3)

Emission Mass	<	0.01	µg
Molecular Weight		64.51	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	8.58E-12	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloroform (67-66-3)

Emission Mass	<	0.01	µg
Molecular Weight		119.38	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloromethane (74-87-3)

Emission Mass	<	0.02	µg
Molecular Weight		50.488	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.59E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		98.95	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	6.67E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		96.94	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg

Tetrachloroethene (127-18-4)

Emission Mass	<	0.02	µg
Molecular Weight		165.82	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.72E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Toluene (108-88-3)

Emission Mass		0.16	µg
Molecular Weight		92.14	lb/lb-mole
Emission Concentration		0.0	mg/DSCM
Emission Concentration		1.55E-10	lb/dscf
Emission Concentration		0.00	ppm_{dv}
Emission Rate		NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.33E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.02	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.53E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Trichloroethene (79-01-6)

Emission Mass	<	0.01	µg
Molecular Weight		131.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Vinyl chloride (75-01-4)

Emission Mass	<	0.01	µg
Molecular Weight		62.498	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.24E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Xylenes (total) (1330-20-7)

Emission Mass	<	0.11	µg
Molecular Weight		106.16	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.04E-10	lb/dscf
Emission Concentration	<	0.0004	ppm_{dv}
Emission Rate	<	NA	lb/hr

Client:	ArcelorMittal Monessen		Test Date:	Oct. 26-27, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Quench Tower		Test Start Time:	5:28 PM	
Unit Operation:	Normal		Test Finish Time:	1:23 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:	1936	
Meter $DH_{@}$ (0.75 scfm)	1.83	in. H_2O
Meter Calibration Factor (Yd)	0.998	
Barometric Pressure (Pbar)	29.26	in. Hg
Stack Static Pressure (Pg)	0.12	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter NA if circular)	216.0	inches
O2 (taken from CEMs spreadsheet)	19.41	% dv
CO2 (taken from CEMs spreadsheet)	0.06	% dv
Product Rate (enter NA if not needed)	NA	ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Flow, Moisture, Phenol	
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	67.0	F
Stack Temperature (Tsavg)	173.5	F
Orifice Pressure Drop (dHavg)	0.425	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2857	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
Total Test Time	7.92	hours
# of quenches	24	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	80.53	% dv
Water Collected (V_f - V_i)	NA	ml
Water Vapor Condensed (Vwc(std))	NA	scf
Water Collected (W_f - W_i)	NA	g
Water Vapor in Silica Gel (Vwsg(std))	NA	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	NA	scf
Volume Dry Gas Metered (Vm)	NA	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	NA	dscf
Volume Dry Gas Metered (Vm(m^3))	NA	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	NA	dscm
Stack Absolute Pressure (Ps)	29.27	in. Hg
Stack Absolute Temperature (Tsavg)	633.2	R
H2O Vapor Pressure @ avg Stack Temp.	13.23	in. Hg
H2O in the gas at saturation (Bws)	0.4521	vol. fraction
H2O in the gas from test data (Bws)	0.2113	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.2113	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.79	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.51	lb/lb-mole
Gas Velocity (Vs)	18.54	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	1,001,047	acfm
Standard Gas Flowrate	816,179	scfm
Dry Standard Gas Flowrate	643,713	dscfm
Actual Gas Flowrate	28,347	acm/min
Standard Gas Flowrate	23,112	scm/min
Dry Standard Gas Flowrate	18,228	dscm/min

ArcelorMittal Monessen Run 3
Quench Tower

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

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)	Sample Train Temp Side A
A-1	0.083	0.288	0.43	179	67	67	19
A-2	0.081	0.285	0.42	174	69	67	19
A-3	0.077	0.277	0.40	183	67	67	19
A-4	0.082	0.286	0.43	181	67	67	19
A-5	0.072	0.268	0.37	184	66	66	19
A-6	0.079	0.281	0.41	178	66	66	19
B-1	0.082	0.286	0.43	170	66	66	19
B-2	0.081	0.285	0.42	170	67	67	19
B-3	0.072	0.268	0.37	178	67	67	19
B-4	0.089	0.298	0.46	178	66	66	19
B-5	0.092	0.303	0.48	172	66	67	19
B-6	0.082	0.286	0.43	180	66	66	19
C-1	0.081	0.285	0.42	172	66	66	19
C-2	0.080	0.283	0.42	178	67	68	19
C-3	0.089	0.298	0.46	168	66	67	19
C-4	0.072	0.268	0.37	167	66	67	19
C-5	0.090	0.300	0.47	169	66	67	19
C-6	0.090	0.300	0.47	165	67	68	19
D-1	0.081	0.285	0.42	162	67	68	19
D-2	0.079	0.281	0.41	168	68	68	19
D-3	0.082	0.286	0.43	165	68	68	19
D-4	0.089	0.298	0.46	170	68	68	19
D-5	0.079	0.281	0.41	178	68	68	19
D-6	0.077	0.277	0.40	175	68	68	19
Average	0.0817	0.2857	0.42	173.5		67.0	19.0

1st Set of Tubes		
Initial volume	0.000	liters
Final volume	20.002	liters
Total metered	20.002	dry actual liters

Leak Check Volume 0.000 dry actual liters

2nd Set of Tubes		
Initial volume	0.000	liters
Final volume	20.187	liters
Total metered	20.187	dry actual liters

Leak Check Volume 0.000 dry actual liters

3rd Set of Tubes		
Initial volume	0.000	liters
Final volume	20.334	liters
Total metered	20.334	dry actual liters

Sample Train Volume	60.523	(liters)
Unspiked Train Meter ID	VOST-1	
Meter Correction Factor	1.008	
VOST meter Temp	19.0	(def C)
VOST meter Temp	66.2	(def F)
Corrected Volume	59.842	(liters, dry standard)
Corrected Volume	0.060	(dscm)

Acrylonitrile (107-13-1)

Emission Mass	<	0.03	µg
Molecular Weight		53.06	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	2.34E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}
Emission Rate	<	NA	lb/hr

Benzene

Emission Mass		1.15	µg
Molecular Weight		78.11	lb/lb-mole
Emission Concentration		0.02	mg/DSCM
Emission Concentration		1.08E-09	lb/dscf
Emission Concentration		0.0053	ppm_{dv}
Emission Rate		NA	lb/hr

Bromoform (75-25-2)

Emission Mass	<	0.01	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.31E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Bromomethane (74-83-9)

Emission Mass	<	0.02	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.41E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Carbon disulfide (75-15-0)

Emission Mass	<	0.03	µg
Molecular Weight		76.139	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	2.44E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Ethylbenzene (100-41-4)

Emission Mass	<	0.01	µg
Molecular Weight		106.17	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.31E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Iodomethane (74-88-4)

Emission Mass	<	0.02	µg
Molecular Weight		141.94	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.41E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Methylene chloride (75-09-2)

Emission Mass		0.05	µg
Molecular Weight		84.93	lb/lb-mole
Emission Concentration		0.00	mg/DSCM
Emission Concentration		4.72E-11	lb/dscf
Emission Concentration		0.0002	ppm_{dv}
Emission Rate		NA	lb/hr

Styrene (100-42-5)

Emission Mass	<	0.01	µg
Molecular Weight		104.15	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		167.848	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.31E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Carbon tetrachloride (56-23-5)

Emission Mass	<	0.02	µg
Molecular Weight		153.82	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.50E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chlorobenzene (108-90-7)

Emission Mass	<	0.01	µg
Molecular Weight		112.56	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.03E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloroethane (75-00-3)

Emission Mass	<	0.01	µg
Molecular Weight		64.51	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	8.43E-12	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloroform (67-66-3)

Emission Mass	<	0.01	µg
Molecular Weight		119.38	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.03E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Chloromethane (74-87-3)

Emission Mass	<	0.02	µg
Molecular Weight		50.488	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.41E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		98.95	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	6.56E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		96.94	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.03E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.01	µg

Tetrachloroethene (127-18-4)

Emission Mass	<	0.02	µg
Molecular Weight		165.82	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.69E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Toluene (108-88-3)

Emission Mass		0.10	µg
Molecular Weight		92.14	lb/lb-mole
Emission Concentration		0.0	mg/DSCM
Emission Concentration		9.18E-11	lb/dscf
Emission Concentration		0.00	ppm_{dv}
Emission Rate		NA	lb/hr

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

Emission Mass	<	0.01	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.31E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Emission Mass	<	0.02	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.50E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Trichloroethene (79-01-6)

Emission Mass	<	0.01	µg
Molecular Weight		131.4	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.03E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	NA	lb/hr

Vinyl chloride (75-01-4)

Emission Mass	<	0.01	µg
Molecular Weight		62.498	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	1.22E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

Xylenes (total) (1330-20-7)

Emission Mass	<	0.03	µg
Molecular Weight		106.16	lb/lb-mole
Emission Concentration	<	0.00	mg/DSCM
Emission Concentration	<	2.81E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	NA	lb/hr

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

Company Name: **Arcelormittal**

Location: **Monessen, PA**

Source Name: **Coke Oven Battery**

Description of Location Sampled (include description of all control devices, quenches, air inlets, etc.): ~~Coke Battery PEC Stack~~ Quench Tower

Run Number: 1
Start Time: 09:10
End Time: 17:32
Date: 10-25-16

Crew: JV JW TM CB
Circle initials of meterbox operator

VOST-1 (Amprobe) Y = 1.008

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

Time: 1600 10/24/16 Initial Measurement (L/min): 0.000
Time: 1602 10/24/16 Final Measurement (L/min): 0.000

Leak Check Criteria - ≤2% of the sampling rate of 0.5 LPM, vacuum 15 in. Hg

Measurement System Leak Checks/Purge

Tube set 1	1A, 1B and 1C			Tube set 2	2A, 2B, and 2C			Tube set 3	3A, 3B and 3C		
Pre (L/min):	0.000	Time:	08:58	Pre (L/min):	0.000	Time:	12:05	Pre (L/min):	0.000	Time:	14:45
Purge (1 L/min):	☑	Time:	NA	Purge (1 L/min):	☑	Time:	12:06	Purge (1 L/min):	☑	Time:	
Post (L/min):	0.000	Time:	11:54	Post (L/min):	0.000	Time:	14:39	Post (L/min):	0.000	Time:	17:35

Leak Check Criteria - ≤2% of the sampling rate of 0.5 LPM, Pre-test vacuum 15 in. Hg, post-test at highest sample vacuum
Initial leak check done from tip of probe. Subsequent leak checks done from 3 way valve.

Temperature, Pressure and Dry Gas Meter Measurements

	Ambient		Time Recorded
Beginning	43	°F	0900
End	53	°F	17:45

	Barometric		
Beginning	29.52	"Hg	09:00
End	29.49	"Hg	17:40

Notes: VOST-1 Y 1.008

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

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

QA/QC:
One Field train blank is required

One Trip blank is required per source also.

	Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time	
Tube set 1	0.0	0	0.5					
	4.0	2.187	0.5	3	248	9	9:10	9:14
	8.0	4.291	0.5	3	247	10	9:21	9:25
	12.0	6.345	0.5	3	248	10	9:34	9:38
	16.0	8.154	0.5	3	246	10	9:48	9:52
	20.0	9.936	0.5	3	246	10	10:40	10:44
	24.0	11.831	0.5	3	248	11	10:53	10:57
	28.0	14.126	0.5	3	248	11	11:05	11:09
	32.0	16.021	0.5	3	247	11	11:19	11:23
	36.0	17.916	0.5	3	245	11	11:32	11:36
	40.0	19.945	0.5	3	249	12	11:47	11:51
							Push Time	
Tube set 2	0.0	0	0.5					
	4.0	1.831	0.5	3	249	13	12:14	12:18
	8.0	3.948	0.5	3	247	13	12:28	12:32
	12.0	5.955	0.5	3	246	14	12:44	12:48
	16.0	7.997	0.5	3	245	14	12:57	13:01
	20.0	9.931	0.5	3	248	15	13:33	13:37
	24.0	11.914	0.5	3	247	15	13:44	13:48
	28.0	14.007	0.5	3	249	15	13:55	13:59
	32.0	16.051	0.5	3	248	14	14:07	14:11
	36.0	17.997	0.5	3	250	14	14:18	14:22
	40.0	19.980	0.5	3	248	14	14:32	14:36
							Push Time	
Tube set 3	0.0	0	0.5					
	4.0	1.937	0.5	3	247	14	14:52	14:56
	8.0	4.162	0.5	3	244	14	15:07	15:11
	12.0	6.204	0.5	3	247	14	15:37	15:41
	16.0	8.020	0.5	3	245	14	15:53	15:57
	20.0	9.952	0.5	3	247	14	16:17	16:21
	24.0	11.980	0.5	3	246	14	16:32	16:36
	28.0	14.070	0.5	3	249	14	16:46	16:50
	32.0	16.111	0.5	3	249	14	17:00	17:04
	36.0	17.955	0.5	3	246	14	17:14	17:18
	40.0	19.950	0.5	3	248	14	17:28	17:32

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

Company Name: **Arcelormittal**

Location: **Monessen, PA**

Source Name: ~~Coke Oven Battery~~ Quench Tower

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

Run Number: 2
Start Time: 18:06 10/25/16
End Time: 16:54 10/26/16
Date:

Crew: JV JW TM CB
Circle initials of meterbox operator

VOST-1 (Average) Y-1.008

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

Time: 16:00 10/24/16 Initial Measurement (L/min): 0.000
Time: 16:02 10/24/16 Final Measurement (L/min): 0.000

Leak Check Criteria - ≤2% of the sampling rate of 0.5 LPM, vacuum 15 in. Hg

Measurement System Leak Checks/Purge

Tube set 1	4A, 4B, + 4C	Tube set 2	5A, 5B, + 5C	Tube set 3	6A, 6B, + 6C
Pre (L/min):	0.000 Time: 18:00	Pre (L/min):	0.000 Time: 20:45	Pre (L/min):	0.002 Time: 14:11
Purge (1 L/min):	☑ Time: 18:02	Purge (1 L/min):	☑ Time: 20:50	Purge (1 L/min):	☑ Time:
Post (L/min):	0.000 Time: 20:35	Post (L/min):	0.002 Time: 14:04	Post (L/min):	0.002 Time: 17:18

Leak Check Criteria - ≤2% of the sampling rate of 0.5 LPM, Pre-test vacuum 15 in. Hg, post-test at highest sample vacuum
Initial leak check done from tip of probe. Subsequent leak checks done from 3 way valve.

Temperature, Pressure and Dry Gas Meter Measurements

	Ambient		Time Recorded
Beginning	53	°F	17:45
End	52.55	°F	~~12~~ 16:51

	Barometric		
Beginning	29.49 ~~29.52~~	"Hg	17:40
End	29.49	"Hg	~~12~~

RCO 10-25-16

Notes: Generator failed ~@ 21:30 on 10/25/16. Replaced Generator and ~~restarted~~ resumed testing @ 12:22 on 10/26/16.

VOST-1 Y1.008

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

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

QA/QC:
One Field train blank is required

One Trip blank is required per source also.

Tube set 1

Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time	
0.0	0	0.5					
4.0	1.955	0.5	2	248	13	18:06	18:10
8.0	3.974	0.5	2	248	13	18:20	18:24
12.0	6.004	0.5	2	247	13	18:32	18:36
16.0	7.906	0.5	2	247	12	19:06	19:10
20.0	10.021	0.5	2	248	11	19:19	19:23
24.0	12.005	0.5	2	247	11	19:32	
28.0	13.917	0.5	2	247	12	19:51	
32.0	15.856	0.5	2	247	12	20:04	
36.0	17.851	0.5	2	247	12	20:18	
40.0	19.759	0.5	2	248	12	20:30	

Tube set 2

Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time
0.0	~~0.187~~	0.5				
4.0	2.187	0.5	2	248	12	20:52
8.0	4.180	0.5	2	247	13	21:22
12.0	6.129	0.5	2	249	11	12:22
16.0	7.929	0.5	2	249	14	12:45
20.0	9.871	0.5	2	250	14	12:57
24.0	11.907	0.5	2	245	15	13:09
28.0	13.981	0.5	2	251	16	13:22
32.0	15.998	0.5	2	248	16	13:35
36.0	17.937	0.5	2	246	16	13:47
40.0	20.039	0.5	2	246	17	13:58
				~~247~~	~~12~~	

Tube set 3

Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time
0.0	0	0.5				
4.0	2.021	0.5	2	247	17	14:17
8.0	4.022	0.5	2	245	17	14:28
12.0	6.013	0.5	2	246	17	14:41
16.0	7.997	0.5	2	249	17	14:53
20.0	9.980	0.5	2	249	17	15:05
24.0	12.019	0.5	2	248	16	15:34
28.0	14.054	0.5	2	247	17	15:49
32.0	16.014	0.5	2	246	17	16:02
36.0	17.958	0.5	2	248	17	16:14
40.0	20.011	0.5	2	248	17	16:51

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

Company Name: **Arcelormittal**

Location: **Monessen, PA**

Source Name: ~~Coke Oven Battery~~ Quench Tower

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

Run Number: 3
Start Time: 1728 10/26/16
End Time: 0124 10/27/16
Date: 10/26/16

Crew: JV JW TM CB
Circle initials of meterbox operator

VOST-1 (Array No) YC 1.008

Field Train Blank System Leak Check

Time: 1600 10/24/16 Initial Measurement (L/min): 0.000
Time: 1602 10/24/16 Final Measurement (L/min): 0.000

Leak Check Criteria - ≤2% of the sampling rate of 0.5 LPM, vacuum 15 in. Hg

Measurement System Leak Checks/Purge

Tube set 1	7A, 7B, + 7C	Tube set 2		Tube set 3	
Pre (L/min):	0.002	Pre (L/min):	0.000	Pre (L/min):	0.000
Time:	17:23	Time:	19:55	Time:	22:48
Purge (1 L/min):	☑	Purge (1 L/min):	☑	Purge (1 L/min):	☑
Time:	17:24	Time:	19:56	Time:	22:43
Post (L/min):	0.000	Post (L/min):	0.000	Post (L/min):	0.000
Time:	19:53	Time:	22:29	Time:	0128

Leak Check Criteria - ≤2% of the sampling rate of 0.5 LPM, Pre-test vacuum 15 in. Hg, post-test at highest sample vacuum
Initial leak check done from tip of probe. Subsequent leak checks done from 3 way valve.

Temperature, Pressure and Dry Gas Meter Measurements

	Ambient		Time Recorded
Beginning	55	°F	17:20
End	43	°F	1124

	Barometric		
Beginning	29.48	"Hg	17:20
End	29.44	"Hg	1124

Notes: VOST-1 Y 1.008

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

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

QA/QC:
One Field train blank is required

One Trip blank is required per source also.

Tube set 1

Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time
0.0	0	0.5				
4.0	2.109	0.5	2	247	17	17:28
8.0	4.057	0.5	2	248	17	17:41
12.0	6.015	0.5	2	250	17	17:53
16.0	7.997	0.5	2	246	17	18:06
20.0	9.957	0.5	2	248	17	18:21
24.0	12.007	0.5	2	245	17	18:32
28.0	14.026	0.5	2	248	17	18:45
32.0	16.041	0.5	2	248	17	19:22
36.0	18.002	0.5	2	248	17	19:35
40.0	20.064	0.5	2	248	17	19:48

Tube set 2

Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time
0.0	0	0.5				
4.0	2.130	0.5	2	248	17	20:00
8.0	4.206	0.5	2	248	17	20:17
12.0	6.180	0.5	2	248	17	20:29
16.0	8.217	0.5	2	248	17	20:40
20.0	10.203	0.5	2	248	17	21:07
24.0	12.109	0.5	2	247	17	21:19
28.0	14.140	0.5	2	247	17	21:32
32.0	16.201	0.5	2	248	17	22:00
36.0	18.120	0.5	2	248	17	22:12
40.0	20.150	0.5	2	247	17	22:26

Tube set 3

Time	Meter	L/min	Vacuum in. hg	Probe °F	Meter °C	Push Time
0.0	0	0.5				
4.0	1.981	0.5	2	247	18	22:47
8.0	3.985	0.5	2	248	18	22:58
12.0	6.012	0.5	2	248	18	23:35
16.0	8.177	0.5	2	248	18	23:47
20.0	10.201	0.5	2	248	18	23:59
24.0	12.228	0.5	2	248	18	24:27
28.0	14.211	0.5	2	248	18	24:38
32.0	16.201	0.5	2	248	18	24:53
36.0	18.228	0.5	2	248	18	25:05
40.0	20.287	0.5	2	248	18	1:19

1:05
1:24

Methods 3A, 6C, 10, 15

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Qunech Tower
Project No	16-167	**Operation**	Normal Load
Plant	Monessen, PA	**Location**	Top of Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	CO (PPMdv)	SO_2 (PPMdv)
RUN 1						
1	2016/11/01	08:51:01	20.41	0.35	129.2	6.5
2	2016/11/01	08:52:01	20.59	0.17	293.2	6.0
3	2016/11/01	08:53:01	20.63	0.16	102.2	2.5
4	2016/11/01	08:54:01	20.63	0.16	41.3	1.3
5	2016/11/01	09:12:01	20.53	0.24	195.3	5.2
6	2016/11/01	09:13:01	20.62	0.16	143.1	4.5
7	2016/11/01	09:14:01	20.63	0.16	59.8	2.0
8	2016/11/01	09:15:01	20.63	0.16	21.2	1.1
9	2016/11/01	09:29:01	20.48	0.27	157.4	5.8
10	2016/11/01	09:30:01	20.61	0.17	181.7	6.2
11	2016/11/01	09:31:01	20.62	0.16	48.1	2.8
12	2016/11/01	09:32:01	20.62	0.16	25.7	1.6
13	2016/11/01	09:42:01	20.40	0.37	79.0	2.1
14	2016/11/01	09:43:01	20.60	0.18	305.2	9.2
15	2016/11/01	09:44:01	20.62	0.16	85.8	3.9
16	2016/11/01	09:45:01	20.63	0.16	0.5	2.0
17	2016/11/01	10:04:01	20.55	0.21	123.2	3.1
18	2016/11/01	10:05:01	20.61	0.17	75.4	3.5
19	2016/11/01	10:06:01	20.62	0.16	-0.1	2.2
20	2016/11/01	10:07:01	20.62	0.16	-3.9	1.6
21	2016/11/01	10:21:01	20.45	0.30	165.7	5.1
22	2016/11/01	10:22:01	20.59	0.17	231.4	7.4
23	2016/11/01	10:23:01	20.61	0.16	6.2	3.1
24	2016/11/01	10:24:01	20.62	0.16	-4.4	1.7
25	2016/11/01	10:34:01	20.47	0.28	266.6	11.2
26	2016/11/01	10:35:01	20.60	0.17	170.0	5.5
27	2016/11/01	10:36:01	20.61	0.17	-1.0	2.4
28	2016/11/01	10:37:01	20.61	0.17	-3.9	1.5
29	2016/11/01	10:49:01	20.56	0.21	-5.4	0.1
30	2016/11/01	10:50:01	19.16	0.18	-4.2	0.2
31	2016/11/01	10:51:01	19.98	0.17	-2.7	0.2
32	2016/11/01	10:52:01	20.55	0.17	-3.8	0.2
33	2016/11/01	10:56:01				
34	2016/11/01	10:57:01				
35	2016/11/01	10:58:01				
36	2016/11/01	10:59:01				
37	2016/11/01	11:14:01	20.30	0.31	29.5	0.8
38	2016/11/01	11:15:01	20.40	0.18	214.5	5.0
39	2016/11/01	11:16:01	20.45	0.17	54.2	2.6
40	2016/11/01	11:17:01	20.46	0.17	25.4	1.4
41	2016/11/01	11:57:01	20.66	0.30	3.5	0.3
42	2016/11/01	11:58:01	20.66	0.24	255.6	6.3
43	2016/11/01	11:59:01	20.75	0.17	109.0	5.3
44	2016/11/01	12:00:01	20.76	0.16	2.0	2.4
45	2016/11/01	12:12:01	20.68	0.26	291.8	6.1
46	2016/11/01	12:13:01	20.77	0.17	183.3	6.9
47	2016/11/01	12:14:01	20.81	0.16	40.8	3.1
48	2016/11/01	12:15:01	20.81	0.16	20.2	1.8
49	2016/11/01	12:24:01	20.60	0.36	14.0	0.9
50	2016/11/01	12:25:01	20.74	0.19	286.9	6.7
51	2016/11/01	12:26:01	20.77	0.16	63.3	4.6
52	2016/11/01	12:27:01	20.81	0.16	2.2	2.5
53	2016/11/01	12:38:01	20.58	0.37	45.4	1.8
54	2016/11/01	12:39:01	20.76	0.18	269.3	9.7
55	2016/11/01	12:40:01	20.79	0.16	41.2	5.1
56	2016/11/01	12:41:01	20.81	0.16	22.2	2.8
57	2016/11/01	12:52:01	20.64	0.29	117.4	4.2
58	2016/11/01	12:53:01	20.77	0.16	149.8	6.6
59	2016/11/01	12:54:01	20.79	0.16	57.4	3.6
60	2016/11/01	12:55:01	20.80	0.16	18.4	2.5
RUN 1 AVERAGES			**20.6**	**0.2**	**92.8**	**3.7**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Qunech Tower
Project No	16-167	**Operation**	Normal Load
Plant	Monessen, PA	**Location**	Top of Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	CO (PPMdv)	SO_2 (PPMdv)
RUN 2						
1	2016/11/01	13:30:01	20.73	0.25	191.7	5.6
2	2016/11/01	13:31:01	20.83	0.16	130.4	5.9
3	2016/11/01	13:32:01	20.84	0.16	45.0	3.3
4	2016/11/01	13:33:01	20.84	0.16	19.0	2.4
5	2016/11/01	13:43:01	20.45	0.42	144.6	9.0
6	2016/11/01	13:44:01	20.75	0.17	339.0	9.7
7	2016/11/01	13:45:01	20.79	0.16	24.1	4.3
8	2016/11/01	13:46:01	20.81	0.16	4.5	2.8
9	2016/11/01	14:17:01	20.57	0.40	187.1	9.0
10	2016/11/01	14:18:01	20.79	0.17	367.7	9.0
11	2016/11/01	14:19:01	20.83	0.15	97.3	4.2
12	2016/11/01	14:20:01	20.84	0.15	33.5	2.8
13	2016/11/01	14:29:01	20.60	0.37	134.6	4.3
14	2016/11/01	14:30:01	20.81	0.16	241.1	9.1
15	2016/11/01	14:31:01	20.84	0.15	81.7	4.5
16	2016/11/01	14:32:01	20.86	0.15	23.9	2.9
17	2016/11/01	14:42:01	20.58	0.41	89.6	5.7
18	2016/11/01	14:43:01	20.77	0.19	457.7	13.8
19	2016/11/01	14:44:01	20.84	0.15	111.5	5.1
20	2016/11/01	14:45:01	20.84	0.16	29.8	3.1
21	2016/11/01	14:55:01	20.64	0.33	134.2	3.5
22	2016/11/01	14:56:01	20.82	0.16	226.1	7.2
23	2016/11/01	14:57:01	20.84	0.15	44.9	3.8
24	2016/11/01	14:58:01	20.84	0.15	14.0	2.7
25	2016/11/01	15:07:01	20.69	0.26	373.9	18.8
26	2016/11/01	15:08:01	20.81	0.15	249.9	7.8
27	2016/11/01	15:09:01	20.84	0.15	80.9	3.7
28	2016/11/01	15:10:01	20.85	0.15	30.5	2.9
29	2016/11/01	15:20:01	20.74	0.23	242.5	5.3
30	2016/11/01	15:21:01	20.83	0.15	130.7	5.8
31	2016/11/01	15:22:01	20.86	0.15	21.7	3.7
32	2016/11/01	15:23:01	20.85	0.15	9.9	2.7
33	2016/11/01	15:38:01	20.75	0.21	424.9	15.2
34	2016/11/01	15:39:01	20.83	0.15	225.5	6.2
35	2016/11/01	15:40:01	20.84	0.15	57.1	3.4
36	2016/11/01	15:41:01	20.84	0.15	13.3	2.7
37	2016/11/01	15:51:01	20.61	0.36	202.5	8.4
38	2016/11/01	15:52:01	20.80	0.16	394.0	10.2
39	2016/11/01	15:53:01	20.83	0.15	130.2	4.2
40	2016/11/01	15:54:01	20.84	0.15	28.0	2.9
41	2016/11/01	16:03:01	20.58	0.36	31.3	4.0
42	2016/11/01	16:04:01	20.74	0.19	458.8	14.7
43	2016/11/01	16:05:01	20.80	0.14	168.8	5.7
44	2016/11/01	16:06:01	20.81	0.14	36.1	3.4
45	2016/11/01	16:49:01	20.63	0.35	93.2	4.0
46	2016/11/01	16:50:01	20.81	0.16	245.1	8.4
47	2016/11/01	16:51:01	20.82	0.15	34.2	4.2
48	2016/11/01	16:52:01	20.83	0.14	14.7	2.9
49	2016/11/01	17:15:01	20.62	0.36	89.0	2.7
50	2016/11/01	17:16:01	20.81	0.16	325.6	8.3
51	2016/11/01	17:17:01	20.83	0.15	81.0	4.3
52	2016/11/01	17:18:01	20.84	0.15	30.1	2.8
53	2016/11/01	17:27:01	20.65	0.33	86.3	2.9
54	2016/11/01	17:28:01	20.80	0.17	326.0	9.3
55	2016/11/01	17:29:01	20.84	0.15	67.8	4.6
56	2016/11/01	17:30:01	20.85	0.15	14.9	2.9
57	2016/11/01	17:40:01	20.66	0.29	128.0	3.3
58	2016/11/01	17:41:01	20.82	0.16	129.6	5.3
59	2016/11/01	17:42:01	20.84	0.15	39.5	3.4
60	2016/11/01	17:43:01	20.85	0.15	9.8	2.5
RUN 2 AVERAGES			**20.8**	**0.2**	**140.9**	**5.8**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Qunech Tower
Project No	16-167	**Operation**	Normal Load
Plant	Monessen, PA	**Location**	Top of Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	CO (PPMdv)	SO_2 (PPMdv)
RUN 3						
1	2016/11/02	07:43:01	20.50	0.36	43.9	1.0
2	2016/11/02	07:44:01	20.67	0.18	254.6	6.9
3	2016/11/02	07:45:01	20.69	0.16	32.5	2.9
4	2016/11/02	07:46:01	20.70	0.16	12.5	1.3
5	2016/11/02	07:58:01	20.52	0.34	202.0	13.7
6	2016/11/02	07:59:01	20.65	0.18	334.2	14.2
7	2016/11/02	08:00:01	20.69	0.16	53.3	4.6
8	2016/11/02	08:01:01	20.70	0.16	44.0	1.9
9	2016/11/02	08:10:01	20.48	0.38	79.1	1.1
10	2016/11/02	08:11:01	20.65	0.18	371.1	9.7
11	2016/11/02	08:12:01	20.69	0.16	93.5	3.9
12	2016/11/02	08:13:01	20.70	0.16	37.6	1.5
13	2016/11/02	08:25:01	20.46	0.41	57.2	3.2
14	2016/11/02	08:26:01	20.64	0.19	373.7	10.6
15	2016/11/02	08:27:01	20.70	0.16	86.5	3.1
16	2016/11/02	08:28:01	20.70	0.16	44.0	1.1
17	2016/11/02	09:07:01	20.57	0.32	10.6	-0.6
18	2016/11/02	09:08:01	20.65	0.21	255.0	5.4
19	2016/11/02	09:09:01	20.69	0.17	91.8	3.6
20	2016/11/02	09:10:01	20.71	0.16	6.0	1.4
21	2016/11/02	09:24:01	20.51	0.37	27.8	0.2
22	2016/11/02	09:25:01	20.66	0.20	380.1	9.4
23	2016/11/02	09:26:01	20.70	0.17	115.2	4.6
24	2016/11/02	09:27:01	20.71	0.17	65.8	1.7
25	2016/11/02	09:38:01	20.50	0.37	43.3	0.4
26	2016/11/02	09:39:01	20.68	0.18	221.8	5.7
27	2016/11/02	09:40:01	20.70	0.17	30.8	2.6
28	2016/11/02	09:41:01	20.71	0.17	5.0	1.1
29	2016/11/02	09:53:01	20.53	0.35	10.8	-0.3
30	2016/11/02	09:54:01	20.64	0.22	325.8	8.0
31	2016/11/02	09:55:01	20.70	0.17	117.3	4.8
32	2016/11/02	09:56:01	20.71	0.17	5.8	1.5
33	2016/11/02	10:06:01	20.58	0.27	166.4	2.7
34	2016/11/02	10:07:01	20.69	0.17	121.5	3.7
35	2016/11/02	10:08:01	20.71	0.17	41.2	1.4
36	2016/11/02	10:09:01	20.72	0.17	11.9	0.6
37	2016/11/02	10:19:01	20.50	0.35	149.9	7.1
38	2016/11/02	10:20:01	20.68	0.18	249.0	7.0
39	2016/11/02	10:21:01	20.71	0.17	15.9	2.3
40	2016/11/02	10:22:01	20.72	0.17	9.8	1.1
41	2016/11/02	10:31:01	20.54	0.34	24.6	0.1
42	2016/11/02	10:32:01	20.65	0.19	303.2	7.0
43	2016/11/02	10:33:01	20.69	0.17	76.1	3.5
44	2016/11/02	10:34:01	20.71	0.17	26.1	1.2
45	2016/11/02	10:43:01	20.49	0.39	24.5	0.6
46	2016/11/02	10:44:01	20.62	0.22	442.2	13.9
47	2016/11/02	10:45:01	20.70	0.17	117.8	4.3
48	2016/11/02	10:46:01	20.70	0.17	7.0	1.5
49	2016/11/02	10:56:01	20.51	0.34	125.3	2.0
50	2016/11/02	10:57:01	20.68	0.17	226.5	6.4
51	2016/11/02	10:58:01	20.71	0.17	15.9	2.3
52	2016/11/02	10:59:01	20.72	0.16	4.8	0.9
53	2016/11/02	11:54:01	20.49	0.38	107.8	5.5
54	2016/11/02	11:55:01	20.66	0.18	373.2	8.6
55	2016/11/02	11:56:01	20.69	0.16	37.4	2.6
56	2016/11/02	11:57:01	20.71	0.16	30.9	1.0
57	2016/11/02	12:08:01	20.54	0.31	250.8	8.8
58	2016/11/02	12:09:01	20.67	0.16	265.5	6.7
59	2016/11/02	12:10:01	20.71	0.16	60.0	2.0
60	2016/11/02	12:11:01	20.72	0.16	7.5	0.9
RUN 3 AVERAGES			**20.6**	**0.2**	**118.8**	**3.9**

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

Client	ArcelorMittal	**Date**	November 1, 2016
Project No	16-167	**Location**	Top of Tower
Plant	Monessen, PA	**Run**	Run 1
Unit	Quench Tower	**Start Time**	8:51
Operation	Normal Load	**End Time**	12:56
Tester(s)	jv		

Cal. Gas	LOW Conc.	LOW (% of Span)	MID Conc.	MID (% of Span)	HIGH Conc.	HIGH (% of Span)	Span	Conc. Units	If Using M205, denote Mass Flow Controller Tank ID LOW	MID	HIGH	M205 Dilution System Information Dilution Cylinder ID	Cylinder Concentration	Response Time (up)	Response Time (down)
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	N/A	N/A	44	43
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	N/A	N/A	45	45
CO	N/A	N/A	246.7	49.0	503.1	100.0	503.1	ppmdv	N/A	SG9107317BAL	SG9150081BAL	N/A	N/A	95	100
SO2	N/A	N/A	25.43	50.9	50	100.0	50	ppmdv	N/A	CC403407	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		0.05	0.15	0.50	-0.12	-0.85	-1.35	20.01	0.015			
	Mid	10.21	10.00	10.01	0.05	10.24	1.20	1.15	20.01	10.125	20.59	20.77	d. vol. %
CO2	Zero		0.06	0.11	0.25	0.15	0.45	0.20	19.81	0.13			
	Mid	10.08	9.88	9.98	0.50	9.98	0.50	0.00	19.81	9.98	0.20	0.07	d. vol. %
CO	Zero		0.0	0.0	0.00	0.8	0.16	0.16	503.1	0.4			
	Mid	246.7	248.0	247.9	-0.02	248.9	0.18	0.20	503.1	248.4	92.77	91.88	ppmdv
SO2	Zero		0.1	1.0	1.8000	1.0	1.80	0.00	50	1			
	Mid	25.43	25.0	24.4	-1.20	24.2	-1.60	-0.40	50	24.3	3.65	2.89	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	0.05	0.25					10.21	10.00	-1.05		20.01	20.05	0.20		20.01	d. vol. %
CO2	0.06	0.30					10.08	9.88	-1.01		19.81	20.00	0.96		19.81	d. vol. %
CO	0.0	0.00					246.70	248.0	0.26		503.1	499.8	-0.66		503.1	ppmdv
SO2	0.1	0.00					25.4	25.0	-0.86		50.0	50.0	0.00		50	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**	November 1, 2016
Project No	16-167	**Location**	Top of Tower
Plant	Monessen, PA	**Run**	Run 2
Unit	Quench Tower	**Start Time**	13:30
Operation	Normal Load	**End Time**	17:44
Tester(s)	jv		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	N/A	N/A
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	N/A	N/A
CO	N/A	N/A	246.7	49.0	503.1	100.0	503.1	ppmdv	N/A	SG9107317BAL	SG9150081BAL	N/A	N/A
SO2	N/A	N/A	25.43	50.9	50	100.0	50	ppmdv	N/A	CC403407	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		0.05	-0.12	-0.85	-0.07	-0.60	0.25	20.01	-0.10			
	Mid	10.21	10.00	10.24	1.20	10.15	0.75	-0.45	20.01	10.20	20.78	20.71	d. vol. %
CO2	Zero		0.06	0.15	0.45	0.15	0.45	0.00	19.81	0.15			
	Mid	10.08	9.88	9.98	0.50	9.98	0.50	0.00	19.81	9.98	0.20	0.05	d. vol. %
CO	Zero		0.0	0.8	0.16	1.3	0.26	0.10	503.1	1.05			
	Mid	246.7	248.0	248.9	0.18	245.9	-0.42	-0.60	503.1	247.4	140.92	140.07	ppmdv
SO2	Zero		0.1	1.0	1.80	1.3	2.40	0.60	50	1.15			
	Mid	25.43	25.0	24.2	-1.60	24.0	-2.00	-0.40	50	24.1	5.76	5.11	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	0.1	0.25					10.21	10.0	-1.05		20.01	20.1	0.20		20.01	d. vol. %
CO2	0.1	0.30					10.08	9.9	-1.01		19.81	20.0	0.96		19.81	d. vol. %
CO	0.0	0.00					246.7	248.0	0.26		503.1	499.8	-0.66		503.1	ppmdv
SO2	0.1	0.00					25.43	25.0	-0.86		50	50.0	0.00		50	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**	November 2, 2017
Project No	16-167	**Location**	Top of Tower
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	7:43
Operation	Normal Load	**End Time**	12:12
Tester(s)	jv		

Cal. Gas	LOW		MID		HIGH		Span	Conc. Units	If Using M205, denote Mass Flow Controller Tank ID			M205 Dilution System Information	
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)			LOW	MID	HIGH	Dilution Cylinder ID	Cylinder Concentration
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	N/A	N/A
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	N/A	N/A
CO	N/A	N/A	246.7	49.0	503.1	100.0	503.1	ppmdv	N/A	SG9107317BAL	SG9150081BAL	N/A	N/A
SO2	N/A	N/A	25.43	50.9	50	100.0	50	ppmdv	N/A	CC403407	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		0.05	-0.06	-0.55	-0.04	-0.45	0.10	20.01	-0.05			
	Mid	10.21	10.00	10.08	0.40	10.16	0.80	0.40	20.01	10.12	20.65	20.78	d. vol. %
CO2	Zero		0.04	0.10	0.30	0.11	0.35	0.05	19.81	0.11			
	Mid	10.08	9.88	10.16	1.41	9.92	0.20	-1.21	19.81	10.04	0.22	0.11	d. vol. %
CO	Zero		0.1	0.3	0.04	0.2	0.02	-0.02	503.1	0.25			
	Mid	246.7	248.0	246.3	-0.34	247.8	-0.04	0.30	503.1	247.05	118.76	118.46	ppmdv
SO2	Zero		0.0	0.1	0.20	0.2	0.40	0.20	50	0.15			
	Mid	25.43	24.9	24.5	-0.80	24.1	-1.60	-0.80	50	24.3	3.93	3.98	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	0.1	0.25					10.21	10.0	-1.05		20.01	20.1	0.20		20.01	d. vol. %
CO2	0.0	0.20					10.08	9.9	-1.01		19.81	19.8	-0.05		19.81	d. vol. %
CO	0.1	0.02					246.7	248.0	0.26		503.1	499.9	-0.64		503.1	ppmdv
SO2	0.0	0.00					25.43	24.9	-1.06		50	50.0	0.00		50	ppmdv
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	November 1, 2016	
Project No.:	16-167		0	Top of Tower	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Quench Tower		Test Start Time:	8:51 AM	
Unit Operation:	Normal Load		Test Finish Time:	12:56 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	
Data Input			**Calculations**		
Control Box:	1774		CO + N2	79.16	% dv
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f- V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.30	in. Hg	Water Collected (W_f- W_i)	567.1	g
Stack Static Pressure (Pg)	0.01	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	26.739	scf
Stack Diameter (Ds) (L if rectangular)	600.0	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	26.739	scf
Stack Width (enter NA if circular)	216.0	inches	Volume Dry Gas Metered (Vm)	166.006	dacf
O2	20.77	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	162.949	dscf
CO2	0.07	% dv	Volume Dry Gas Metered ($Vm(m^3)$)	4.701	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.614	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.30	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	638.0	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	14.76	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	0.5038	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1410	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1410	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Meter Temperature (Tm)	73.1	F	Wet Gas Molecular Weight (Ms)	27.31	lb/lb-mole
Stack Temperature (Tsavg)	178.4	F	Gas Velocity (Vs)	17.94	ft/s
Orifice Pressure Drop (dHavg)	2.581	in. H_2O	Is the stack circular or rectangular?	RECTANGULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.2798	in. H_2O^1/2	Area Stack (As)	900.000	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	968,900	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	784,808	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	674,180	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	27,436	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	22,223	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	19,091	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	4.08	hours			
# of quenches	36	quenches/test			
Avg. # of quenches per hour	3.30	quenches/hour			
Minutes per quench	5.00	minutes/quench			

Carbon Monoxide (CO)			**Carbon Dioxide (CO2)**		
MW	28	lb/lb-mole	MW	44	lb/lb-mole
Concentration	91.88	ppm_v	Concentration	709.1	ppm_v
Concentration	0.0000067	lb/dscf	Emission	NA	g/hr
Emission	NA	lb/quench	Emission	NA	lb/hr
Emission	NA	lb/hr	Emission	NA	tons/hr

Sulfur Dioxide (SO2)		
MW	64	lb/lb-mole
Concentration	2.89	ppm_v
Concentration	0.0000005	lb/dscf
Emission	NA	lb/quench
Emission	NA	lb/hr

Hydrogen Sulfide		
MW	34.1	lb/lb-mole
Concentration	< 0.50	ppm_v
Concentration	< 0.58	ppm_v
Concentration	< 0.000000051	lb/dscf
Emission	< NA	lb/quench
Emission	< NA	lb/hr

ArcelorMittal Quench Tower — **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)	Out (F or C)
A-1	0.078	0.279	2.6	179	66	66
A-1	0.075	0.274	2.5	183	65	66
A-1	0.081	0.285	2.7	175	65	66
A-2	0.076	0.276	2.5	179	67	67
A-2	0.083	0.288	2.7	188	67	67
A-2	0.081	0.285	2.7	186	68	68
A-3	0.077	0.277	2.5	179	70	68
A-3	0.080	0.283	2.6	181	70	69
A-3	0.082	0.286	2.7	189	72	71
B-1	0.075	0.274	2.5	179	73	72
B-1	0.072	0.268	2.4	173	74	73
B-1	0.085	0.292	2.8	185	74	74
B-2	0.080	0.283	2.6	180	75	75
B-2	0.076	0.276	2.5	173	76	76
B-2	0.071	0.266	2.3	179	77	76
B-3	0.081	0.285	2.7	178	78	77
B-3	0.076	0.276	2.5	184	79	78
B-3	0.079	0.281	2.6	185	79	78
C-1	0.084	0.290	2.8	176	79	78
C-1	0.081	0.285	2.7	175	78	78
C-1	0.074	0.272	2.4	181	78	78
C-2	0.076	0.276	2.5	186	78	78
C-2	0.080	0.283	2.6	175	78	78
C-2	0.082	0.286	2.7	181	77	78
C-3	0.078	0.279	2.6	184	76	77
C-3	0.084	0.290	2.8	180	75	75
C-3	0.076	0.276	2.5	181	75	75
D-1	0.076	0.276	2.5	167	73	75
D-1	0.072	0.268	2.4	170	73	74
D-1	0.081	0.285	2.7	175	72	72
D-2	0.081	0.285	2.7	167	72	72
D-2	0.077	0.277	2.5	170	72	72
D-2	0.077	0.277	2.5	170	71	72
D-3	0.080	0.283	2.6	178	71	71
D-3	0.076	0.276	2.5	172	71	71
D-3	0.076	0.276	2.5	178	70	71
Average	0.0783	0.2798	2.58	178.4		73.1

Initial volume	617.908	ft^3	Initial volume	0.000	liters
Final volume	783.914	ft^3	Final volume	0.000	liters
Total metered	166.006	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	865.3	370.3	495.0			0.0
2	702.4	689.6	12.8			0.0
3	710.1	704.4	5.7			0.0
4	623.6	619.0	4.6			0.0
5	823.3	774.3	49.0			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	3724.7	3157.6	567.1	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:	November 1, 2016	
Project No.:	16-167		Test Location:	Top of Tower	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Quench Tower		Test Start Time:	1:30 PM	
Unit Operation:	Normal Load		Test Finish Time:	5:44 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774	
Meter $DH@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Barometric Pressure (Pbar)	29.30	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600	inches
Stack Width (enter NA if circular)	216	inches
O2	20.71	% dv
CO2	0.05	% 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)	73.1	F
Stack Temperature (Tsavg)	178.4	F
Orifice Pressure Drop (dHavg)	2.581	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2798	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
Total Test Time	4.23	hours
# of quenches	36	quenches/test
Avg. # of quenches per hour	3.30	quenches/hour
Minutes per quench	5.00	minutes/quench

Calculations

CO + N2	79.24	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	567.1	g
Water Vapor in Silica Gel (Vwsg(std))	26.739	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	26.739	scf
Volume Dry Gas Metered (Vm)	166.006	dscf
Vol. Dry Gas Metered Stand.(Vm(std))	162.949	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	4.701	dscm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.614	dscm
Stack Absolute Pressure (Ps)	29.30	in. Hg
Stack Absolute Temperature (Tsavg)	638.0	R
H2O Vapor Pressure @ avg Stack Temp.	14.76	in. Hg
H2O in the gas at saturation (Bws)	0.5038	vol. fraction
H2O in the gas from test data (Bws)	0.1410	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1410	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.31	lb/lb-mole
Gas Velocity (Vs)	17.94	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	968,990	acfm
Standard Gas Flowrate	784,881	scfm
Dry Standard Gas Flowrate	674,242	dscfm
Actual Gas Flowrate	27,439	acm/min
Standard Gas Flowrate	22,225	scm/min
Dry Standard Gas Flowrate	19,093	dscm/min

Carbon Monoxide (CO)

MW	28	lb/lb-mole
Concentration	140.07	ppm_w
Concentration	0.0000102	lb/dscf
Emission	NA	lb/quench
Emission	NA	lb/hr

Carbon Dioxide (CO2)

MW	44	lb/lb-mole
Concentration	504.5	ppm_w
Emission	NA	g/hr
Emission	NA	lb/hr
Emission	NA	tons/hr

Sulfur Dioxide (SO2)

MW	64	lb/lb-mole
Concentration	5.11	ppm_w
Concentration	0.0000008	lb/dscf
Emission	NA	lb/quench
Emission	NA	lb/hr

Hydrogen Sulfide

MW		34.1	lb/lb-mole
Concentration	<	0.50	ppm_w
Concentration	<	0.58	ppm_w
Concentration	<	0.000000051	lb/dscf
Emission	<	NA	lb/quench
Emission	<	NA	lb/hr

ArcelorMittal Run 2 F or C?
Quench Tower 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	0.078	0.279	2.6	179	66	66
A-1	0.075	0.274	2.5	183	65	66
A-1	0.081	0.285	2.7	175	65	66
A-2	0.076	0.276	2.5	179	67	67
A-2	0.083	0.288	2.7	188	67	67
A-2	0.081	0.285	2.7	186	68	68
A-3	0.077	0.277	2.5	179	70	68
A-3	0.080	0.283	2.6	181	70	69
A-3	0.082	0.286	2.7	189	72	71
B-1	0.075	0.274	2.5	179	73	72
B-1	0.072	0.268	2.4	173	74	73
B-1	0.085	0.292	2.8	185	74	74
B-2	0.080	0.283	2.6	180	75	75
B-2	0.076	0.276	2.5	173	76	76
B-2	0.071	0.266	2.3	179	77	76
B-3	0.081	0.285	2.7	178	78	77
B-3	0.076	0.276	2.5	184	79	78
B-3	0.079	0.281	2.6	185	79	78
C-1	0.084	0.290	2.8	176	79	78
C-1	0.081	0.285	2.7	175	78	78
C-1	0.074	0.272	2.4	181	78	78
C-2	0.076	0.276	2.5	186	78	78
C-2	0.080	0.283	2.6	175	78	78
C-2	0.082	0.286	2.7	181	77	78
C-3	0.078	0.279	2.6	184	76	77
C-3	0.084	0.290	2.8	180	75	75
C-3	0.076	0.276	2.5	181	75	75
D-1	0.076	0.276	2.5	167	73	75
D-1	0.072	0.268	2.4	170	73	74
D-1	0.081	0.285	2.7	175	72	72
D-2	0.081	0.285	2.7	167	72	72
D-2	0.077	0.277	2.5	170	72	72
D-2	0.077	0.277	2.5	170	71	72
D-3	0.080	0.283	2.6	178	71	71
D-3	0.076	0.276	2.5	172	71	71
D-3	0.076	0.276	2.5	178	70	71
Average	0.0783	0.2798	2.58	178.4		73.1

Initial volume	617.908	ft^3	Initial volume	0.000	liters
Final volume	783.914	ft^3	Final volume	0.000	liters
Total metered	166.006	dscf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	865.3	370.3	495.0			0.0
2	702.4	689.6	12.8			0.0
3	710.1	704.4	5.7			0.0
4	623.6	619.0	4.6			0.0
5	823.3	774.3	49.0			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	3724.7	3157.6	567.1	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:	November 2, 2017	
Project No.:	16-167		Test Location:	Top of Tower	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Quench Tower		Test Start Time:	7:43 AM	
Unit Operation:	Normal Load		Test Finish Time:	12:12 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774		**Calculations**		
Meter DH@ (0.75 scfm)	1.977	in. H_2O	CO + N2	79.11	% dv
Meter Calibration Factor (Yd)	1.006		Water Collected (V_f - V_i)	0.0	ml
Barometric Pressure (Pbar)	29.30	in. Hg	Water Vapor Condensed (Vwc(std))	0.000	scf
Stack Static Pressure (Pg)	0.01	in. H_2O	Water Collected (W_f - W_i)	647.4	g
Stack Diameter (Ds) (L if rectangular)	600	inches	Water Vapor in Silica Gel (Vwsg(std))	30.526	scf
Stack Width (enter NA if circular)	216	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	30.526	scf
O2	20.78	% dv	Volume Dry Gas Metered (Vm)	159.829	dacf
CO2	0.11	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	157.663	dscf
Product Rate (enter NA if not needed)	NA	ton/hr	Volume Dry Gas Metered ($Vm(m^3)$)	4.526	dacm
Is the input ton/hr metric? (YES=1)	0		Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.465	dscm
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Pressure (Ps)	29.30	in. Hg
Sample Calculation Title	Flow, Moisture, CEMS		Stack Absolute Temperature (Tsavg)	632.1	R
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O Vapor Pressure @ avg Stack Temp.	12.90	in. Hg
Standard Temperature	68	F	H2O in the gas at saturation (Bws)	0.4403	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas from test data (Bws)	0.1622	vol. fraction
Pitot Tube Constant (Kp)	85.49		H2O in the gas used (lower of the 2 Bws)	0.1622	vol. fraction
Calculations			Is the Gas Stream Saturated With H2O?	NO	
Meter Temperature (Tm)	70.3	F	Dry Gas Molecular Weight (Md)	28.85	lb/lb-mole
Stack Temperature (Tsavg)	172.4	F	Wet Gas Molecular Weight (Ms)	27.09	lb/lb-mole
Orifice Pressure Drop (dHavg)	2.406	in. H_2O	Gas Velocity (Vs)	17.34	ft/s
GasVelocity Head $(dP)^{1/2}$avg	0.2706	in. H_2O^1/2	Is the stack circular or rectangular?	RECTANGULAR	
			Area Stack (As)	900.000	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	936,499	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	765,727	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	641,518	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	26,519	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	21,683	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	18,166	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	4.48	hours			
# of quenches	36	quenches/test			
Avg. # of quenches per hour	3.30	quenches/hour			
Minutes per quench	5.00	minutes/quench			

Carbon Monoxide (CO)

			Carbon Dioxide (CO2)		
MW	28	lb/lb-mole	MW	44	lb/lb-mole
Concentration	118.46	ppm_v	Concentration	1,133.8	ppm_v
Concentration	0.0000086	lb/dscf	Emission	NA	g/hr
Emission	NA	lb/quench	Emission	NA	lb/hr
Emission	NA	lb/hr	Emission	NA	tons/hr

Sulfur Dioxide (SO2)

MW	64	lb/lb-mole
Concentration	3.98	ppm_v
Concentration	0.0000007	lb/dscf
Emission	NA	lb/quench
Emission	NA	lb/hr

Hydrogen Sulfide

MW		34.1	lb/lb-mole
Concentration	<	0.50	ppm_v
Concentration	<	0.60	ppm_v
Concentration	<	0.000000053	lb/dscf
Emission	<	NA	lb/quench
Emission	<	NA	lb/hr

ArcelorMittal Run 3 F or C?
Quench Tower 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	0.080	0.283	2.6	165	74	76
A-1	0.081	0.285	2.7	170	74	75
A-1	0.068	0.261	2.2	177	73	74
A-2	0.072	0.268	2.4	167	72	73
A-2	0.075	0.274	2.5	180	72	73
A-2	0.076	0.276	2.5	181	71	72
A-3	0.068	0.261	2.2	181	70	71
A-3	0.080	0.283	2.6	170	71	73
A-3	0.080	0.283	2.6	180	72	73
B-1	0.070	0.265	2.3	176	73	73
B-1	0.068	0.261	2.2	175	73	74
B-1	0.076	0.276	2.5	178	72	73
B-2	0.070	0.265	2.3	168	72	73
B-2	0.070	0.265	2.3	175	70	71
B-2	0.072	0.268	2.4	180	70	71
B-3	0.072	0.268	2.4	173	70	71
B-3	0.080	0.283	2.6	168	70	71
B-3	0.075	0.274	2.5	170	72	72
C-1	0.070	0.265	2.3	170	72	72
C-1	0.068	0.261	2.2	170	72	72
C-1	0.075	0.274	2.5	165	72	72
C-2	0.073	0.270	2.4	172	68	68
C-2	0.074	0.272	2.4	171	67	67
C-2	0.073	0.270	2.4	172	67	68
C-3	0.071	0.266	2.3	169	66	65
C-3	0.074	0.272	2.4	171	65	65
C-3	0.075	0.274	2.5	168	66	66
D-1	0.073	0.270	2.4	172	66	65
D-1	0.070	0.265	2.3	170	66	68
D-1	0.068	0.261	2.2	173	69	66
D-2	0.072	0.268	2.4	175	67	66
D-2	0.075	0.274	2.5	173	68	66
D-2	0.077	0.277	2.5	169	69	67
D-3	0.073	0.270	2.4	169	70	68
D-3	0.072	0.268	2.4	172	72	73
D-3	0.071	0.266	2.3	171	74	70
Average	0.0733	0.2706	2.41	172.4		70.3

Initial volume	785.057	ft^3	Initial volume	0.000	liters
Final volume	944.886	ft^3	Final volume	0.000	liters
Total metered	159.829	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1199.4	614.6	584.8			0.0
2	678.7	668.0	10.7			0.0
3	702.5	700.1	2.4			0.0
4	352.9	351.0	1.9			0.0
5	822.7	775.1	47.6			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	3756.2	3108.8	647.4	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**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	HCl (PPMwv)	HCN (PPMwv)	HF (PPMwv)
RUN 1							
1	11/1/2016	11:14:35 AM	20.48	0.17	-0.033	3.442	0.052
2	11/1/2016	11:15:34 AM	20.30	0.31	-0.121	2.046	0.052
3	11/1/2016	11:16:35 AM	20.40	0.18	-0.344	2.015	0.052
4	11/1/2016	11:17:34 AM	20.45	0.17	-0.188	1.197	0.052
5	11/1/2016	11:18:34 AM			0.018	1.266	0.051
6	11/1/2016	11:57:33 AM	20.81	0.16	0.041	1.257	0.052
7	11/1/2016	11:58:33 AM	20.66	0.30	-0.310	1.439	0.052
8	11/1/2016	11:59:33 AM	20.66	0.24	-0.253	1.059	0.052
9	11/1/2016	12:00:33 PM	20.75	0.17	-0.293	1.217	0.052
10	11/1/2016	12:01:33 PM			-0.057	1.127	0.052
11	11/1/2016	12:11:33 PM	20.84	0.16	0.015	1.011	0.052
12	11/1/2016	12:12:33 PM	20.74	0.26	-0.329	1.128	0.052
13	11/1/2016	12:13:32 PM	20.68	0.26	-0.241	0.727	0.052
14	11/1/2016	12:14:33 PM	20.77	0.17	-0.356	1.020	0.052
15	11/1/2016	12:15:33 PM			-0.052	0.928	0.052
16	11/1/2016	12:24:32 PM	20.83	0.16	-0.062	1.384	0.052
17	11/1/2016	12:25:32 PM	20.60	0.36	-0.356	0.758	0.052
18	11/1/2016	12:26:32 PM	20.74	0.19	-0.468	0.981	0.052
19	11/1/2016	12:27:32 PM	20.77	0.16	-0.305	0.934	0.052
20	11/1/2016	12:28:32 PM			-0.070	0.982	0.052
21	11/1/2016	12:38:32 PM	20.83	0.16	-0.173	0.941	0.052
22	11/1/2016	12:39:32 PM	20.58	0.37	-0.249	0.569	0.052
23	11/1/2016	12:40:32 PM	20.76	0.18	-0.419	0.954	0.052
24	11/1/2016	12:41:32 PM	20.79	0.16	-0.123	0.785	0.052
25	11/1/2016	12:42:32 PM			0.077	0.809	0.052
26	11/1/2016	12:51:31 PM	20.82	0.16	0.089	0.413	0.052
27	11/1/2016	12:52:31 PM	20.72	0.23	-0.496	1.276	0.052
28	11/1/2016	12:53:31 PM	20.64	0.29	-0.281	0.614	0.052
29	11/1/2016	12:54:31 PM	20.77	0.16	-0.375	0.939	0.052
30	11/1/2016	12:55:31 PM			-0.141	0.743	0.052
31	11/1/2016	1:04:31 PM	20.86	0.16	0.047	0.850	0.052
32	11/1/2016	1:05:31 PM	20.69	0.32	-0.420	1.791	0.052
33	11/1/2016	1:06:31 PM	20.62	0.34	-0.442	1.098	0.052
34	11/1/2016	1:07:31 PM	20.83	0.16	-0.340	0.909	0.052
35	11/1/2016	1:08:31 PM			-0.108	0.913	0.052
36	11/1/2016	1:16:31 PM	20.87	0.16	0.003	0.689	0.052
37	11/1/2016	1:17:31 PM	20.72	0.30	-0.241	1.159	0.052
38	11/1/2016	1:18:31 PM	20.73	0.25	-0.451	1.054	0.052
39	11/1/2016	1:19:31 PM	20.83	0.16	-0.331	0.828	0.052
40	11/1/2016	1:20:31 PM			-0.057	0.933	0.052
41	11/1/2016	1:29:30 PM	20.75	0.17	-0.003	0.963	0.052
42	11/1/2016	1:30:30 PM	20.79	0.16	-0.477	1.211	0.052
43	11/1/2016	1:31:30 PM	20.81	0.16	-0.370	1.178	0.052
44	11/1/2016	1:32:30 PM	20.87	0.15	-0.189	0.686	0.052
45	11/1/2016	1:33:30 PM			0.099	0.705	0.052
46	11/1/2016	1:43:30 PM	20.57	0.40	-0.332	7.652	0.052
47	11/1/2016	1:44:30 PM	20.79	0.17	-0.280	2.314	0.052
48	11/1/2016	1:45:30 PM	20.85	0.16	-0.381	1.877	0.052
49	11/1/2016	1:46:30 PM	20.60	0.37	-0.346	1.330	0.052
50	11/1/2016	1:47:30 PM			-0.071	1.256	0.052
51	11/1/2016	2:16:29 PM	20.81	0.16	0.089	0.464	0.052
52	11/1/2016	2:17:29 PM	20.84	0.15	-0.402	2.181	0.052
53	11/1/2016	2:18:29 PM	20.86	0.15	-0.341	0.904	0.052
54	11/1/2016	2:19:29 PM	20.58	0.41	-0.388	1.307	0.052
55	11/1/2016	2:20:29 PM			-0.222	0.815	0.052
56	11/1/2016	2:29:29 PM	20.77	0.19	-0.357	1.500	0.052
57	11/1/2016	2:30:28 PM	20.84	0.15	-0.291	0.865	0.052
58	11/1/2016	2:31:28 PM	20.86	0.16	-0.411	1.007	0.052
59	11/1/2016	2:32:28 PM	20.64	0.33	-0.148	0.860	0.052
60	11/1/2016	2:33:28 PM			0.085	0.841	0.052
RUN 1 AVERAGES			**20.75**	**0.22**	**-0.223**	**1.166**	**0.052**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	HCl (PPMwv)	HCN (PPMwv)	HF (PPMwv)
RUN 2							
1	11/2/2016	7:43:13 AM	20.74	0.16	-0.013	0.888	0.052
2	11/2/2016	7:44:13 AM	20.50	0.36	-0.301	0.892	0.052
3	11/2/2016	7:45:13 AM	20.67	0.18	-0.453	1.271	0.052
4	11/2/2016	7:46:13 AM	20.69	0.16	-0.258	0.699	0.051
5	11/2/2016	7:47:13 AM			0.012	0.800	0.051
6	11/2/2016	7:57:12 AM	20.70	0.18	0.066	0.443	0.051
7	11/2/2016	7:58:12 AM	20.35	0.54	-0.079	1.204	0.052
8	11/2/2016	7:59:12 AM	20.52	0.34	-0.332	0.571	0.052
9	11/2/2016	8:00:12 AM	20.65	0.18	-0.441	1.274	0.052
10	11/2/2016	8:01:12 AM			-0.237	0.749	0.051
11	11/2/2016	8:10:16 AM	20.72	0.16	-0.051	1.056	0.052
12	11/2/2016	8:11:16 AM	20.48	0.38	-0.279	0.872	0.052
13	11/2/2016	8:12:15 AM	20.65	0.18	-0.506	0.950	0.052
14	11/2/2016	8:13:15 AM	20.69	0.16	-0.270	0.670	0.051
15	11/2/2016	8:14:15 AM			-0.062	0.809	0.051
16	11/2/2016	8:25:15 AM	20.73	0.16	-0.040	0.929	0.052
17	11/2/2016	8:26:15 AM	20.46	0.41	-0.308	0.704	0.052
18	11/2/2016	8:27:15 AM	20.64	0.19	-0.317	0.705	0.052
19	11/2/2016	8:28:15 AM	20.70	0.16	-0.366	0.875	0.051
20	11/2/2016	8:29:15 AM			-0.103	0.858	0.051
21	11/2/2016	9:07:13 AM	20.57	0.32	0.036	0.337	0.051
22	11/2/2016	9:08:13 AM	20.65	0.21	-0.438	1.459	0.052
23	11/2/2016	9:09:13 AM	20.69	0.17	-0.324	0.682	0.052
24	11/2/2016	9:10:13 AM	20.71	0.16	-0.395	0.834	0.051
25	11/2/2016	9:11:13 AM			-0.092	0.815	0.051
26	11/2/2016	9:24:13 AM	20.74	0.17	0.035	0.562	0.051
27	11/2/2016	9:25:13 AM	20.51	0.37	-0.505	1.759	0.052
28	11/2/2016	9:26:13 AM	20.66	0.20	-0.521	0.928	0.052
29	11/2/2016	9:27:13 AM	20.70	0.17	-0.360	0.911	0.051
30	11/2/2016	9:28:13 AM			-0.057	0.818	0.051
31	11/2/2016	9:38:12 AM	20.74	0.17	-0.014	0.743	0.051
32	11/2/2016	9:39:13 AM	20.50	0.37	-0.292	0.894	0.052
33	11/2/2016	9:40:12 AM	20.68	0.18	-0.463	0.963	0.052
34	11/2/2016	9:41:12 AM	20.70	0.17	-0.352	0.842	0.051
35	11/2/2016	9:42:12 AM			-0.037	0.862	0.051
36	11/2/2016	9:53:12 AM	20.73	0.17	0.107	0.348	0.051
37	11/2/2016	9:54:12 AM	20.53	0.35	-0.432	1.639	0.052
38	11/2/2016	9:55:12 AM	20.64	0.22	-0.316	0.557	0.052
39	11/2/2016	9:56:12 AM	20.70	0.17	-0.435	0.865	0.051
40	11/2/2016	9:57:11 AM			-0.148	0.622	0.051
41	11/2/2016	10:06:11 AM	20.65	0.25	-0.231	0.929	0.052
42	11/2/2016	10:07:11 AM	20.58	0.27	-0.328	0.700	0.052
43	11/2/2016	10:08:11 AM	20.69	0.17	-0.427	0.869	0.051
44	11/2/2016	10:09:11 AM	20.71	0.17	-0.174	0.621	0.051
45	11/2/2016	10:10:11 AM			0.035	0.684	0.051
46	11/2/2016	10:19:11 AM	20.68	0.21	-0.048	1.205	0.052
47	11/2/2016	10:20:11 AM	20.50	0.35	-0.337	0.635	0.052
48	11/2/2016	10:21:11 AM	20.68	0.18	-0.465	1.210	0.052
49	11/2/2016	10:22:11 AM	20.71	0.17	-0.238	0.652	0.051
50	11/2/2016	10:23:11 AM			0.040	0.701	0.051
51	11/2/2016	10:31:10 AM	20.73	0.17	0.037	0.559	0.051
52	11/2/2016	10:32:10 AM	20.54	0.34	-0.304	0.837	0.052
53	11/2/2016	10:33:10 AM	20.65	0.19	-0.348	0.458	0.052
54	11/2/2016	10:34:10 AM	20.69	0.17	-0.413	0.856	0.051
55	11/2/2016	10:35:10 AM			-0.071	0.929	0.051
56	11/2/2016	10:43:10 AM	20.74	0.16	0.020	0.482	0.051
57	11/2/2016	10:44:10 AM	20.49	0.39	-0.505	1.319	0.052
58	11/2/2016	10:45:10 AM	20.62	0.22	-0.373	0.563	0.052
59	11/2/2016	10:46:10 AM	20.70	0.17	-0.427	0.814	0.051
60	11/2/2016	10:47:10 AM			-0.162	0.685	0.051
RUN 2 AVERAGES			**20.64**	**0.23**	**-0.237**	**0.833**	**0.052**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Top of Quench Tower

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	HCl (PPMwv)	HCN (PPMwv)	HF (PPMwv)
RUN 3							
1	11/2/2016	10:56:09 AM	20.51	0.34	-0.006	1.194	0.052
2	11/2/2016	10:57:09 AM	20.68	0.17	-0.324	0.474	0.052
3	11/2/2016	10:58:09 AM	20.71	0.17	-0.494	0.896	0.052
4	11/2/2016	10:59:09 AM	20.73	0.16	-0.246	0.695	0.051
5	11/2/2016	11:00:09 AM			-0.032	0.833	0.051
6	11/2/2016	11:11:09 AM	20.49	0.38	-0.286	1.324	0.052
7	11/2/2016	11:12:09 AM	20.66	0.18	-0.214	0.704	0.051
8	11/2/2016	11:13:09 AM	20.69	0.16	-0.384	0.529	0.050
9	11/2/2016	11:14:09 AM	20.68	0.22	-0.230	0.655	0.054
10	11/2/2016	11:15:09 AM			-0.200	0.673	0.054
11	11/2/2016	11:55:09 AM	20.54	0.31	-0.302	1.177	0.052
12	11/2/2016	11:56:09 AM	20.67	0.16	-0.331	0.634	0.051
13	11/2/2016	11:57:09 AM	20.71	0.16	-0.322	0.560	0.054
14	11/2/2016	11:58:09 AM			-0.273	0.658	0.051
15	11/2/2016	11:59:09 AM			-0.453	0.643	0.050
16	11/2/2016	12:19:09 PM	20.42	0.43	-0.219	1.115	0.053
17	11/2/2016	12:20:09 PM	20.64	0.17	-0.325	0.763	0.052
18	11/2/2016	12:21:09 PM	20.68	0.16	-0.199	0.604	0.052
19	11/2/2016	12:22:09 PM	20.69	0.16	-0.364	0.616	0.051
20	11/2/2016	12:23:09 PM			-0.314	0.530	0.052
21	11/2/2016	12:34:09 PM	20.71	0.15	-0.379	1.045	0.052
22	11/2/2016	12:35:09 PM	20.42	0.42	-0.357	0.662	0.051
23	11/2/2016	12:36:09 PM	20.62	0.19	-0.293	0.546	0.055
24	11/2/2016	12:37:09 PM	20.67	0.15	-0.456	0.716	0.053
25	11/2/2016	12:38:09 PM			-0.350	0.529	0.052
26	11/2/2016	12:49:09 PM	20.66	0.19	-0.363	0.840	0.053
27	11/2/2016	12:50:09 PM	20.45	0.36	-0.329	0.731	0.051
28	11/2/2016	12:51:09 PM	20.64	0.16	-0.383	0.713	0.050
29	11/2/2016	12:52:09 PM	20.67	0.15	-0.330	0.622	0.054
30	11/2/2016	12:53:09 PM			-0.240	0.629	0.052
31	11/2/2016	1:03:09 PM			-0.321	1.082	0.054
32	11/2/2016	1:04:09 PM			-0.368	0.608	0.055
33	11/2/2016	1:05:09 PM			-0.432	0.608	0.054
34	11/2/2016	1:06:09 PM			-0.261	0.628	0.050
35	11/2/2016	1:07:09 PM			-0.253	0.626	0.055
36	11/2/2016	1:24:09 PM			-0.356	1.182	0.052
37	11/2/2016	1:25:09 PM			-0.309	0.750	0.054
38	11/2/2016	1:26:09 PM			-0.308	0.647	0.055
39	11/2/2016	1:27:09 PM			-0.427	0.676	0.050
40	11/2/2016	1:28:09 PM			-0.112	0.576	0.053
41	11/2/2016	1:39:09 PM			-0.478	1.263	0.052
42	11/2/2016	1:40:09 PM			-0.302	0.640	0.055
43	11/2/2016	1:41:09 PM			-0.366	0.605	0.050
44	11/2/2016	1:42:09 PM			-0.363	0.613	0.053
45	11/2/2016	1:43:09 PM			-0.307	0.565	0.053
46	11/2/2016	2:13:09 PM			-0.330	1.410	0.054
47	11/2/2016	2:14:09 PM			-0.299	0.652	0.053
48	11/2/2016	2:15:09 PM			-0.327	0.623	0.052
49	11/2/2016	2:16:09 PM			-0.309	0.698	0.053
50	11/2/2016	2:17:09 PM			-0.308	0.736	0.051
51	11/2/2016	2:26:09 PM			-0.200	1.128	0.051
52	11/2/2016	2:27:09 PM			-0.405	0.558	0.054
53	11/2/2016	2:28:09 PM			-0.316	0.531	0.053
54	11/2/2016	2:29:09 PM			-0.343	0.631	0.054
55	11/2/2016	2:30:09 PM			-0.198	0.617	0.050
56	11/2/2016	2:49:09 PM			-0.115	0.939	0.054
57	11/2/2016	2:50:09 PM			-0.354	0.770	0.054
58	11/2/2016	2:51:09 PM			-0.243	0.538	0.052
59	11/2/2016	2:52:09 PM			-0.326	0.628	0.050
60	11/2/2016	2:53:09 PM			-0.334	0.530	0.052
RUN 3 AVERAGES			**20.6**	**0.2**	**-0.314**	**0.732**	**0.052**

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

Client	ArcelorMittal	Date	Nov. 1, 2016
Project No	16-167	Location	Top of Quench Tower
Plant	Monessen, PA	Run	Run 1
Unit	Quench Tower	Start Time	11:13
Operation	Normal	End Time	14:44
Tester(s)	BC, JW, TM, CB		

Cal. Gas	LOW Conc.	LOW (% of Span)	MID Conc.	MID (% of Span)	HIGH Conc.	HIGH (% of Span)	Span	Conc. Units	If Using M205, denote Mass Flow Controller Tank ID LOW	MID	HIGH	M205 Dilution System Information Dilution Cylinder ID	Cylinder Concentration	Response Time (sec) Up	Down
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	NA	NA	44	45
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	NA	NA	45	44
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	0.17	0.55	-0.15	-1.05	-1.60	20.01	0.01			
	Mid	10.21	10.17	10.12	-0.25	10.26	0.45	0.70	20.01	10.19	20.75	20.80	d. vol. %
CO2	Zero		0.05	-0.05	-0.50	0.15	0.50	1.01	19.81	0.05			
	Mid	10.08	9.89	9.74	-0.76	9.98	0.45	1.21	19.81	9.86	0.22	0.17	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Nov. 1, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 2
Unit	Quench Tower	**Start Time**	7:43
Operation	Normal	**End Time**	10:48
Tester(s)	BC, JW, TM, CB		

Cal.	LOW		MID		HIGH				If Using M205, denote Mass Flow Controller			M205 Dilution System Information	
									Tank ID			Dilution	Cylinder
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Conc. Units	LOW	MID	HIGH	Cylinder ID	Concentration
O2	N/A	N/A	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	NA	NA
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	NA	NA
LIMITS				40 % to 60 %		100%							

				Initial Values		Final Values								
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.06	-0.15	-1.05	-0.04	-0.50	0.55	20.01	-0.10			
	Mid	10.21	10.17	10.26	0.45	10.16	-0.05	-0.50	20.01	10.21	20.64	20.54	d. vol. %
CO2	Zero		0.05	0.15	0.50	0.11	0.30	-0.20	19.81	0.13			
	Mid	10.08	9.89	9.98	0.45	9.92	0.15	-0.30	19.81	9.95	0.23	0.10	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					10.21	10.17	-0.20		20.01	20.10	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.15	1.72		19.81	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**	Nov. 1, 2016
Project No	16-167	**Location**	Top of Quench Tower
Plant	Monessen, PA	**Run**	Run 3
Unit	Quench Tower	**Start Time**	10:56
Operation	Normal	**End Time**	14:54
Tester(s)	BC, JW, TM, CB		

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	10.21	51.0	20.01	100.0	20.01	d. vol. %	N/A	CC465758	CC3414	NA	NA
CO2	N/A	N/A	10.08	50.9	19.81	100.0	19.81	d. vol. %	N/A	CC465758	CC3414	NA	NA
LIMITS				40 % to 60 %		100%							

				Initial Values		Final Values								
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.06	-0.04	-0.50	-0.04	-0.50	0.00	20.01	-0.04			
	Mid	10.21	10.17	10.16	-0.05	10.16	-0.05	0.00	20.01	10.16	20.62	20.68	d. vol. %
CO2	Zero		0.05	0.11	0.30	0.11	0.30	0.00	19.81	0.11			
	Mid	10.08	9.89	9.92	0.15	9.92	0.15	0.00	19.81	9.92	0.22	0.11	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					10.21	10.17	-0.20		20.01	20.1	0.45		20.01	d. vol. %
CO2	0.05	0.25					10.08	9.89	-0.96		19.81	20.2	1.72		19.81	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	Nov. 1, 2016
Project No.:	16-167		Test Location:	Top of Quench Tower
Plant:	Monessen, PA		Test Run:	Run 1
Unit:	Quench Tower		Test Start Time:	11:13 AM
Unit Operation:	Normal		Test Finish Time:	2:44 PM

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

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Barometric Pressure (Pbar)	29.30	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600.0	inches
Stack Width (enter NA if circular)	216.0	inches
O2	20.80	% dv
CO2	0.17	% 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, M320	
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)	73.1	F
Stack Temperature (Tsavg)	178.4	F
Orifice Pressure Drop (dHavg)	2.581	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2798	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
Total Test Time	3.52	hours
# of Quenches	12	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.02	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	567.1	g
Water Vapor in Silica Gel (Vwsg(std))	26.739	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	26.739	scf
Volume Dry Gas Metered (Vm)	166.006	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	162.949	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	4.701	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.614	dscm
Stack Absolute Pressure (Ps)	29.30	in. Hg
Stack Absolute Temperature (Tsavg)	638.0	R
H2O Vapor Pressure @ avg Stack Temp.	14.76	in. Hg
H2O in the gas at saturation (Bws)	0.5038	vol. fraction
H2O in the gas from (Bws)	0.1410	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1410	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.86	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.33	lb/lb-mole
Gas Velocity (Vs)	17.94	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	968,633	acfm
Standard Gas Flowrate	784,592	scfm
Dry Standard Gas Flowrate	673,994	dscfm
Actual Gas Flowrate	27,429	acm/min
Standard Gas Flowrate	22,217	scm/min
Dry Standard Gas Flowrate	19,085	dscm/min

HCl

MW	36.46094	lb/lb-mole
Concentration	< 0.22	ppm_{wv}
Concentration	< 0.26	ppm_{dv}
Concentration	< 0.0000000	lb/dscf
Concentration	< 0.43	mg/dscm
Emission	< NA	lb/hr

HF

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

HCN

MW	27.0253	lb/lb-mole
Concentration	1.17	ppm_{wv}
Concentration	1.36	ppm_{dv}
Concentration	0.0000000	lb/dscf
Concentration	1.64	mg/dscm
Emission	NA	lb/hr

ArcelorMittal Quench Tower — **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	0.078	0.279	2.6	179	66	66
A-1	0.075	0.274	2.5	183	65	66
A-1	0.081	0.285	2.7	175	65	66
A-2	0.076	0.276	2.5	179	67	67
A-2	0.083	0.288	2.7	188	67	67
A-2	0.081	0.285	2.7	186	68	68
A-3	0.077	0.277	2.5	179	70	68
A-3	0.080	0.283	2.6	181	70	69
A-3	0.082	0.286	2.7	189	72	71
B-1	0.075	0.274	2.5	179	73	72
B-1	0.072	0.268	2.4	173	74	73
B-1	0.085	0.292	2.8	185	74	74
B-2	0.080	0.283	2.6	180	75	75
B-2	0.076	0.276	2.5	173	76	76
B-2	0.071	0.266	2.3	179	77	76
B-3	0.081	0.285	2.7	178	78	77
B-3	0.076	0.276	2.5	184	79	78
B-3	0.079	0.281	2.6	185	79	78
C-1	0.084	0.290	2.8	176	79	78
C-1	0.081	0.285	2.7	175	78	78
C-1	0.074	0.272	2.4	181	78	78
C-2	0.076	0.276	2.5	186	78	78
C-2	0.080	0.283	2.6	175	78	78
C-2	0.082	0.286	2.7	181	77	78
C-3	0.078	0.279	2.6	184	76	77
C-3	0.084	0.290	2.8	180	75	75
C-3	0.076	0.276	2.5	181	75	75
D-1	0.076	0.276	2.5	167	73	75
D-1	0.072	0.268	2.4	170	73	74
D-1	0.081	0.285	2.7	175	72	72
D-2	0.081	0.285	2.7	167	72	72
D-2	0.077	0.277	2.5	170	72	72
D-2	0.077	0.277	2.5	170	71	72
D-3	0.080	0.283	2.6	178	71	71
D-3	0.076	0.276	2.5	172	71	71
D-3	0.076	0.276	2.5	178	70	71
Average	0.08	0.280	2.58	178.4		73.1

Initial volume	617.908	ft^3	Initial volume	0.000	liters
Final volume	783.914	ft^3	Final volume	0.000	liters
Total metered	166.006	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	865.3	370.3	495.0			0.0
2	702.4	689.6	12.8			0.0
3	710.1	704.4	5.7			0.0
4	623.6	619.0	4.6			0.0
5	823.3	774.3	49.0			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	3724.7	3157.6	567.1	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal		Test Date:	Nov. 2, 2016
Project No.:	16-167		Test Location:	Top of Quench Tower
Plant:	Monessen, PA		Test Run:	Run 2
Unit:	Quench Tower		Test Start Time:	7:43 AM
Unit Operation:	Normal		Test Finish Time:	10:48 AM

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

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Barometric Pressure (Pbar)	29.30	in. Hg
Stack Static Pressure (Pg)	0.01	in. H_2O
Stack Diameter (Ds) (L if rectangular)	600	inches
Stack Width (enter NA if circular)	216	inches
O2	20.54	% dv
CO2	0.10	% 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)	70.3	F
Stack Temperature (Tsavg)	172.4	F
Orifice Pressure Drop (dHavg)	2.406	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.2706	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
Total Test Time	3.08	hours
# of Quenches	12	Quenches/test
Avg. # of Quenches per hour	3.30	Quenches/hour
Minutes per Quench	5.00	minutes/Quench

Calculations

CO + N2	79.35	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	647.4	g
Water Vapor in Silica Gel (Vwsg(std))	30.526	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	30.526	scf
Volume Dry Gas Metered (Vm)	159.829	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	157.663	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	4.526	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.465	dscm
Stack Absolute Pressure (Ps)	29.30	in. Hg
Stack Absolute Temperature (Tsavg)	632.1	R
H2O Vapor Pressure @ avg Stack Temp.	12.90	in. Hg
H2O in the gas at saturation (Bws)	0.4403	vol. fraction
H2O in the gas from test data (Bws)	0.1622	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1622	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.08	lb/lb-mole
Gas Velocity (Vs)	17.35	ft/s
Is the stack circular or rectangular?	RECTANGULAR	
Area Stack (As)	900.000	ft^2
Actual Gas Flowrate	936,659	acfm
Standard Gas Flowrate	765,858	scfm
Dry Standard Gas Flowrate	641,627	dscfm
Actual Gas Flowrate	26,523	acm/min
Standard Gas Flowrate	21,687	scm/min
Dry Standard Gas Flowrate	18,169	dscm/min

HCl

MW	36.46094	lb/lb-mole
Concentration	< 0.22	ppm_w
Concentration	< 0.27	ppm_d
Concentration	< 0.0000000	lb/dscf
Concentration	< 0.44	mg/dscm
Emission	< NA	lb/hr

HF

MW	20.01	lb/lb-mole
Concentration	< 0.05	ppm_w
Concentration	< 0.06	ppm_d
Concentration	< 0.0000000	lb/dscf
Concentration	< 0.06	mg/dscm
Emission	< NA	lb/hr

HCN

MW	27.0253	lb/lb-mole
Concentration	0.83	ppm_w
Concentration	0.99	ppm_d
Concentration	0.0000000	lb/dscf
Concentration	1.20	mg/dscm
Emission	NA	lb/hr

ArcelorMittal Quench Tower — **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	0.080	0.283	2.6	165	74	76
A-1	0.081	0.285	2.7	170	74	75
A-1	0.068	0.261	2.2	177	73	74
A-2	0.072	0.268	2.4	167	72	73
A-2	0.075	0.274	2.5	180	72	73
A-2	0.076	0.276	2.5	181	71	72
A-3	0.068	0.261	2.2	181	70	71
A-3	0.080	0.283	2.6	170	71	73
A-3	0.080	0.283	2.6	180	72	73
B-1	0.070	0.265	2.3	176	73	73
B-1	0.068	0.261	2.2	175	73	74
B-1	0.076	0.276	2.5	178	72	73
B-2	0.070	0.265	2.3	168	72	73
B-2	0.070	0.265	2.3	175	70	71
B-2	0.072	0.268	2.4	180	70	71
B-3	0.072	0.268	2.4	173	70	71
B-3	0.080	0.283	2.6	168	70	71
B-3	0.075	0.274	2.5	170	72	72
C-1	0.070	0.265	2.3	170	72	72
C-1	0.068	0.261	2.2	170	72	72
C-1	0.075	0.274	2.5	165	72	72
C-2	0.073	0.270	2.4	172	68	68
C-2	0.074	0.272	2.4	171	67	67
C-2	0.073	0.270	2.4	172	67	68
C-3	0.071	0.266	2.3	169	66	65
C-3	0.074	0.272	2.4	171	65	65
C-3	0.075	0.274	2.5	168	66	66
D-1	0.073	0.270	2.4	172	66	65
D-1	0.070	0.265	2.3	170	66	68
D-1	0.068	0.261	2.2	173	69	66
D-2	0.072	0.268	2.4	175	67	66
D-2	0.075	0.274	2.5	173	68	66
D-2	0.077	0.277	2.5	169	69	67
D-3	0.073	0.270	2.4	169	70	68
D-3	0.072	0.268	2.4	172	72	73
D-3	0.071	0.266	2.3	171	74	70
Average	0.07	0.271	2.41	172.4		70.3

Initial volume	785.057	ft^3	Initial volume	0.000	liters
Final volume	944.886	ft^3	Final volume	0.000	liters
Total metered	159.829	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1199.4	614.6	584.8			0.0
2	678.7	668.0	10.7			0.0
3	702.5	700.1	2.4			0.0
4	352.9	351.0	1.9			0.0
5	822.7	775.1	47.6			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	3756.2	3108.8	647.4	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:	Nov. 2, 2016	
Project No.:	16-167		Test Location:	Top of Quench Tower	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Quench Tower		Test Start Time:	10:56 AM	
Unit Operation:	Normal		Test Finish Time:	2:54 PM	

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

Data Input			**Calculations**		
Control Box:	1774		CO + N2	79.21	% dv
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.30	in. Hg	Water Collected (W_f - W_i)	647.4	g
Stack Static Pressure (Pg)	0.01	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	30.526	scf
Stack Diameter (Ds) (L if rectangular)	600	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	30.526	scf
Stack Width (enter NA if circular)	216	inches	Volume Dry Gas Metered (Vm)	159.829	dacf
O2	20.68	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	157.663	dscf
CO2	0.11	% dv	Volume Dry Gas Metered ($Vm(m^3)$)	4.526	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.465	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.30	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	632.1	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	12.90	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	0.4403	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1622	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1622	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	28.84	lb/lb-mole
Meter Temperature (Tm)	70.3	F	Wet Gas Molecular Weight (Ms)	27.09	lb/lb-mole
Stack Temperature (Tsavg)	172.4	F	Gas Velocity (Vs)	17.34	ft/s
Orifice Pressure Drop (dHavg)	2.406	in. H_2O	Is the stack circular or rectangular?	RECTANGULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.2706	in. H_2O^1/2	Area Stack (As)	900.000	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	936,564	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	765,780	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	641,562	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	26,521	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	21,685	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	18,167	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Total Test Time	3.97	hours			
# of Quenches	12	Quenches/test			
Avg. # of Quenches per hour	3.30	Quenches/hour			
Minutes per Quench	5.00	minutes/Quench			

HCl

MW	36.46094	lb/lb-mole
Concentration	< 0.22	ppm_{wv}
Concentration	< 0.27	ppm_{dv}
Concentration	< 0.0000000	lb/dscf
Concentration	< 0.44	mg/dscm
Emission	< NA	lb/hr

HF

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

HCN

MW	27.0253	lb/lb-mole
Concentration	0.73	ppm_{wv}
Concentration	0.87	ppm_{dv}
Concentration	0.0000000	lb/dscf
Concentration	1.05	mg/dscm
Emission	NA	lb/hr

ArcelorMittal Quench Tower — **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	0.080	0.283	2.6	165	74	76
A-1	0.081	0.285	2.7	170	74	75
A-1	0.068	0.261	2.2	177	73	74
A-2	0.072	0.268	2.4	167	72	73
A-2	0.075	0.274	2.5	180	72	73
A-2	0.076	0.276	2.5	181	71	72
A-3	0.068	0.261	2.2	181	70	71
A-3	0.080	0.283	2.6	170	71	73
A-3	0.080	0.283	2.6	180	72	73
B-1	0.070	0.265	2.3	176	73	73
B-1	0.068	0.261	2.2	175	73	74
B-1	0.076	0.276	2.5	178	72	73
B-2	0.070	0.265	2.3	168	72	73
B-2	0.070	0.265	2.3	175	70	71
B-2	0.072	0.268	2.4	180	70	71
B-3	0.072	0.268	2.4	173	70	71
B-3	0.080	0.283	2.6	168	70	71
B-3	0.075	0.274	2.5	170	72	72
C-1	0.070	0.265	2.3	170	72	72
C-1	0.068	0.261	2.2	170	72	72
C-1	0.075	0.274	2.5	165	72	72
C-2	0.073	0.270	2.4	172	68	68
C-2	0.074	0.272	2.4	171	67	67
C-2	0.073	0.270	2.4	172	67	68
C-3	0.071	0.266	2.3	169	66	65
C-3	0.074	0.272	2.4	171	65	65
C-3	0.075	0.274	2.5	168	66	66
D-1	0.073	0.270	2.4	172	66	65
D-1	0.070	0.265	2.3	170	66	68
D-1	0.068	0.261	2.2	173	69	66
D-2	0.072	0.268	2.4	175	67	66
D-2	0.075	0.274	2.5	173	68	66
D-2	0.077	0.277	2.5	169	69	67
D-3	0.073	0.270	2.4	169	70	68
D-3	0.072	0.268	2.4	172	72	73
D-3	0.071	0.266	2.3	171	74	70
Average	0.07	0.271	2.41	172.4		70.3

Initial volume	785.057	ft^3	Initial volume	0.000	liters
Final volume	944.886	ft^3	Final volume	0.000	liters
Total metered	159.829	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1199.4	614.6	584.8			0.0
2	678.7	668.0	10.7			0.0
3	702.5	700.1	2.4			0.0
4	352.9	351.0	1.9			0.0
5	822.7	775.1	47.6			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	3756.2	3108.8	647.4	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

Methods 5/202

EPA METHOD 5
ACETONE BLANK ANALYTICAL DATA

Client:	ArcelorMittal
Project No:	16-167
Location:	Monessen, PA
Blank Sample Date:	October 31, 2017
Test Date(s):	10/27/16-10/31/16
Analysis Dates:	11/14/16-12/2/16
Analyst:	EH
Acetone Blank No:	**439B**

ACETONE BLANK	UNITS	
Acetone density (p_a)	g/ml	0.7899
Acetone blank volume (Va)	ml	200
Final (total) weight 1	mg	114,845.90
Final (total) weight 2	mg	114,846.30
Final (total) weight difference (absolute value) (1)	mg	0.40
Average final (total) weight	mg	114,846.10
Tare weight 1	mg	114,845.80
Tare weight 2	mg	114,845.90
Tare weight difference (absolute value) (1)	mg	0.10
Average tare weight	mg	114,845.85
Average final (total) weight minus average tare weight	mg	0.25
Mass of residue of acetone (m_a) (2)	mg	0.25
Acetone blank residue concentration (Ca) calculated (3)	mg/g	0.0016
Acetone blank correction as a % of acetone mass	%	0.0002
Acetone blank residue concentration (Ca) used (4)	**mg/g**	**0.0016**

ANALYST SIGNATURE: (5) [illegible] for EH

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 5/202
WATER BLANK ANALYTICAL DATA

Client: ArcelorMittal
Project No.: 16-167
Location: Monessen, PA
Blank Sample Date: October 31, 2017
Test Date(s): 10/27/16-10/31/16
Analysis Dates: 11/14/16-12/2/16
Analyst: EH
Water Blank No.: **439C**

WATER BLANK	UNITS	
Water Density (p_a)	g/ml	1.0000
Water Blank Volume (V_a)	ml	200
Final (Total) Weight 1 After Evaporation	mg	125,630.7
Final (Total) Weight 2 After Evaporation	mg	125,630.4
Final (Total) Weight Difference (Absolute Value) (1)	mg	0.30
Average Final (Total) Weight After Evaporation	mg	125,630.55
Tare Weight 1	mg	125,629.9
Tare Weight 2	mg	125,629.7
Tare Weight Difference (Absolute Value) (1)	mg	0.20
Average Tare Weight	mg	125,629.80
Average Final (Total) Weight Minus Average Tare Weight	mg	0.75
Mass of Residue of Water After Evaporation (m_a) (2)	mg	0.75
Water Blank Residue Concentration (C_a) Calculated (3)	**mg/g**	**0.0038**

ANALYST SIGNATURE: (4) MED for EH

COMMENTS:

NOTES:

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

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

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

(4) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data has 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 5/202
HEXANE BLANK ANALYTICAL DATA

Client:	ArcelorMittal
Project No.:	16-167
Location:	Monessen, PA
Blank Sample Date:	October 31, 2017
Test Date(s):	10/27/16-10/31/16
Analysis Dates:	11/14/16-12/2/16
Analyst:	EH
Hexane Blank No.:	**439D**

HEXANE BLANK	UNITS	
Hexane Density (p_a)	g/ml	0.6548
Hexane Blank Volume (V_a)	ml	200
Final (Total) Weight 1 After Evaporation	mg	107,594.5
Final (Total) Weight 2 After Evaporation	mg	107,594.1
Final (Total) Weight Difference (Absolute Value) (1)	mg	0.40
Average Final (Total) Weight After Evaporation	mg	107,594.30
Tare Weight 1	mg	107,593.1
Tare Weight 2	mg	107,593.0
Tare Weight Difference (Absolute Value) (1)	mg	0.10
Average Tare Weight	mg	107,593.05
Average Final (Total) Weight Minus Average Tare Weight	mg	1.25
Mass of Residue of Hexane After Evaporation (m_a) (2)	mg	1.25
Hexane Blank Residue Concentration (C_a) Calculated (3)	**mg/g**	**0.0095**

ANALYST SIGNATURE: (4) MED for EH

COMMENTS:

NOTES:

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

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

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

(4) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data has 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 5/202
FIELD TRAIN BLANK ANALYTICAL DATA

Client: ArcelorMittal
Project No.: 16-167
Location: Monessen, PA
Blank Sample Date: October 31, 2017
Test Date(s): 10/27/16-10/31/16
Analysis Dates: 11/14/16-12/2/16
Analyst: EH

INORGANIC FRACTION FIELD TRAIN BLANK	UNITS	
Water Density (p_a)	g/ml	1.0000
Water Blank Volume (V_a)	ml	164
Initial pH		6.51
Final pH		7.11
Evaporated Water Blank Volume	ml	10
Evaporated Water Blank Tin No.		443U
Final (Total) Weight 1 After Evaporation	mg	2,285.2
Final (Total) Weight 2 After Evaporation	mg	2,285.0
Final (Total) Weight Difference (Absolute Value) (1)	mg	0.20
Average Final (Total) Weight After Evaporation	mg	2,285.10
Tare Weight 1	mg	2,284.8
Tare Weight 2	mg	2,284.7
Tare Weight Difference (Absolute Value) (1)	mg	0.10
Average Tare Weight	mg	2,284.75
Average Final (Total) Weight Minus Average Tare Weight	mg	0.35
Normality of Ammonium Hydroxide (NH_4OH)	N	0.1
Volume of Titrant	ml	0.001
Mass of Ammonium (NH_4)	mg	0.002
Weight of Inorganic Fraction (Ammonium Corrected)	mg	0.35
Mass of Residue of Water (m_{ib}) (2)	**mg**	**0.35**

ORGANIC FRACTION FIELD TRAIN BLANK	UNITS	
Hexane Density (p_a)	g/ml	0.6548
Hexane Blank Volume (V_a)	ml	184
Evaporated Hexane Blank Volume	ml	
Evaporated Hexane Blank Tin No.		443Y
Final (Total) Weight 1 After Evaporation	mg	2,343.4
Final (Total) Weight 2 After Evaporation	mg	2,343.5
Final (Total) Weight Difference (Absolute Value) (1)	mg	0.10
Average Final (Total) Weight After Evaporation	mg	2,343.45
Tare Weight 1	mg	2,343.2
Tare Weight 2	mg	2,343.2
Tare Weight Difference (Absolute Value) (1)	mg	0.00
Average Tare Weight	mg	2,343.20
Average Final (Total) Weight Minus Average Tare Weight	mg	0.25
Mass of Residue of Hexane (m_{ob}) (2)	**mg**	**0.25**

Total Field Train Blank (m_{fb}) (2) (3)	**mg**	**0.60**

ANALYST SIGNATURE: (4) M=D for EH

COMMENTS:

NOTES:

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

(2) If m_{ib}, m_{ob}, or m_{fb} are negative, the values will be set equal to 0.

(3) The maximum allowable field train blank correction is 2.00 mg.

(4) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data has 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
ml - Milliliters
N - Normality

EPA METHOD 5 and 202
PARTICULATE ANALYTICAL DATA

Client: ArcelorMittal
Project No: 16-167
Location: Monessen, PA
Test Date(s): 10/27/16-10/31/16
Analysis Dates: 11/14/16-12/2/16
Analyst: EH
Blank No: **439B**

	UNITS	RUN NO. 1	RUN NO. 2	RUN NO. 3
METHOD 5				
ACETONE WASH				
Acetone wash container No.		**439E**	**439F**	**439G**
Acetone volume used in wash (Vaw)	ml	398.0	416.0	402.0
Acetone density (p_a)	g/ml	0.7899	0.7899	0.7899
Acetone blank residue concentration (Ca)	mg/g	0.0016	0.0016	0.0016
Weight of residue in acetone wash (Wa)	mg	0.4975	0.5200	0.5025
Acetone Wash Final (Total) Weight 1	mg	110,853.20	111,442.70	103,765.80
Acetone Wash Final (Total) Weight 2	mg	110,853.20	111,442.50	103,765.90
Acetone Wash Final (Total) Difference (Absolute Value) (1)	mg	0.00	0.20	0.10
Average final (total) weight	mg	110,853.20	111,442.60	103,765.85
Tare weight 1	mg	110,839.00	111,293.60	103,725.40
Tare weight 2	mg	110,839.00	111,293.70	103,725.40
Tare weight difference (absolute value) (1)	mg	0.00	0.10	0.00
Average tare weight	mg	110,839.00	111,293.65	103,725.40
Weight gain	mg	14.20	148.95	40.45
Weight of particulate matter in acetone wash	mg	13.70	148.43	39.95
FRONT HALF FILTER				
Filter No.		**7187**	**7215**	**7193**
Filter Final (Total) Weight 1	mg	354.70	374.40	360.10
Filter Final (Total) Weight 2	mg	354.60	374.70	360.00
Filter Final (Total) Difference (Absolute Value) (1)	mg	0.10	0.30	0.10
Average Final (Total) Weight	mg	354.65	374.55	360.05
Tare Weight 1	mg	345.30	364.20	343.90
Tare Weight 2	mg	345.20	364.20	343.80
Tare Weight Difference (Absolute Value) (1)	mg	0.10	0.00	0.10
Average Tare Weight	mg	345.25	364.20	343.85
Weight of particulate matter on filter (weight gain)	mg	9.40	10.35	16.20

METHOD 202

CONDENSABLE PARTICULATE				
Inorganic Fraction (H_2O)				
Container No.		**443R**	**443S**	**443T**
Inorganic Fraction Volume	ml	186	304	366
Sample Aliquot Volume	ml	10	10	10
Sample Volume Less Aliquot Volume	ml	176	294	356
Initial pH	pH	2.77	3.10	2.85
Final pH	pH	7.00	7.08	7.05
Water Density (p_a)	g/ml	1.0000	1.0000	1.0000
Final (Total) Weight 1 After Evaporation	mg	2334.6	2334.3	2333.3
Final (Total) Weight 2 After Evaporation	mg	2334.5	2334.0	2333.3
Final (Total) Weight Difference (Absolute Value) (1)	mg	0.10	0.30	0.00
Average Final (Total) Weight After Evaporation	mg	2,334.55	2,334.15	2,333.30
Tare Weight 1	mg	2326.8	2324.6	2324.9
Tare Weight 2	mg	2326.7	2324.7	2324.9
Tare Weight Difference (Absolute Value) (1)	mg	0.10	0.10	0.00
Average Tare Weight	mg	2,326.75	2,324.65	2,324.90
Average Final (Total) Weight Minus Average Tare Weight (2)	mg	7.80	9.50	8.40
Inorganic Fraction Particulate Weight Volume Corrected (2)	mg	8.24	9.82	8.64
Normality of Ammonium Hydroxide (NH_4OH)	N	0.1	0.1	0.1
Volume of Titrant	ml	0.400	0.250	0.310
Mass of Ammonium (NH_4)	mg	0.681	0.426	0.528
Weight of inorganic fraction, ammonia corrected (2)	mg	7.56	9.40	8.11
Organic Fraction (Hexane)				
Container No.		**443V**	**443W**	**443X**
Organic Fraction Volume	ml	170	186	202
Hexane Density (p_a)	g/ml	0.6548	0.6548	0.6548
Final (Total) Weight 1 After Evaporation	mg	2282.8	2362.9	2348.1
Final (Total) Weight 2 After Evaporation	mg	2282.8	2363.1	2348.2
Final (Total) Weight Difference (Absolute Value) (1)	mg	0.00	0.20	0.10
Average Final (Total) Weight After Evaporation	mg	2,282.80	2,363.00	2,348.15
Tare Weight 1	mg	2277.4	2360.1	2346.6
Tare Weight 2	mg	2277.4	2360.2	2346.6
Tare Weight Difference (Absolute Value) (1)	mg	0.00	0.10	0.00
Average Tare Weight		2,277.40	2,360.15	2,346.60
Organic Fraction particulate weight (2)	mg	5.40	2.85	1.55
Total Weight of Condensable Particulate	mg	12.96	12.25	9.66
Total Field Train Blank (m_{fb})	mg	0.60	0.60	0.60
Total weight of Condensable particulate - blank	**mg**	**12.36**	**11.65**	**9.06**
TOTAL PARTICULATE				
Acetone Wash Particulate (2)	mg	13.70	148.43	39.95
Filter Particulate (2)	mg	9.40	10.35	16.20
Condensable Particulate (Field Train Blank Corrected) (2)	mg	12.36	11.65	9.06
TOTAL WEIGHT OF PARTICULATE (m_n)	**mg**	**35.47**	**170.43**	**65.21**

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.

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

Methods 5/29/315

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Your Project #: 106377/ (16-167)
Your C.O.C. #: 23261,22710

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/25
Report #: R4260538
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6O2329
Received: 2016/11/07, 18:30

Sample Matrix: Stack Sampling Train
Samples Received: 21

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Mercury 3C in HCl Rinse	6	2016/11/18	2016/11/21	BRL SOP-00104	EPA M29/M0060 m
Mercury 2B in HNO3/H2O2 Imp.	6	2016/11/18	2016/11/21	BRL SOP-00104	EPA M29/M0060 m
Mercury 3B in KMnO4/H2SO4 Imp.	6	2016/11/16	2016/11/17	BRL SOP-00104	EPA M29/M0060 m
Mercury 1B in Filter + Rinse (M29)	6	2016/11/16	2016/11/17	BRL SOP-00104	EPA 29 m
Mercury 1B in Filter + Rinse (M29)	6	2016/11/23	2016/11/21	BRL SOP-00104	EPA 29 m
Metals B.H. in H2O2/HNO3 Imp.(6020A)	6	2016/11/14	2016/11/14	BRL SOP-00103 / BRL SOP-00102	EPA M29/CARB 436 m
Metals F.H. in Filter + Rinses (6020A)	6	2016/11/16	2016/11/23	BRL SOP-00103/ BRL SOP-00102	EPA M29/CARB 436 m
Metals F.H. in Filter + Rinses (6020A)	6	2016/11/18	2016/11/23	BRL SOP-00103/ BRL SOP-00102	EPA M29/CARB 436 m
Particulates/Acetone Rinse (M5/315/M201)	6	2016/11/09	2016/11/15	BRL SOP-00109	EPA 5/315 m
Particulates/Acetone Rinse (M5/315/M201)	3	2016/11/11	2016/11/15	BRL SOP-00109	EPA 5/315 m
Particulates B. H. Water Imp. (M315)	3	2016/11/14	2016/11/18	BRL SOP-00109	EPA 315
Particulates/Filter (M5/315/NJATM1/M201)	6	N/A	2016/11/11	BRL SOP-00109	EPA 5/315/NJATM1 m
Particulates/Filter (M5/315/NJATM1/M201)	3	N/A	2016/11/14	BRL SOP-00109	EPA 5/315/NJATM1 m
Final Volume of Acetone Probe Rinse	6	N/A	2016/11/11	BRL SOP-00109	
Final Volume of Acetone Probe Rinse	3	N/A	2016/11/21	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.

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

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A Bureau Veritas Group Company

Your Project #: 106377/ (16-167)
Your C.O.C. #: 23261,22710

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/25
Report #: R4260538
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6O2329
Received: 2016/11/07, 18:30

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.

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
25 Nov 2016 15:27:26

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 #: B6O2329
Report Date: 2016/11/25

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

EPA M29 METALS (FRONT & BACK SEPARATE)

Maxxam ID		DKG394	DKG395	DKG396			DKG474			
Sampling Date		2016/10/25	2016/10/25	2016/10/25			2016/10/26			
COC Number		23261,22710	23261,22710	23261,22710			23261,22710			
	UNITS	**M5/29 PEC-R1**	**M5/29 PEC-R2**	**M5/29 PEC-R3**	**RDL**	**MDL**	**M5/29 QUENCH-R1**	**RDL**	**MDL**	**QC Batch**
Metals										
Front Half Antimony (Sb)	ug	<0.80	<0.80	<0.80	0.80	0.080	<2.0	2.0	0.20	4750416
Front Half Arsenic (As)	ug	<0.80	<0.80	<0.80	0.80	0.080	18.6	2.0	0.20	4750416
Front Half Beryllium (Be)	ug	<0.20	<0.20	0.78	0.20	0.040	<0.50	0.50	0.10	4750416
Front Half Cadmium (Cd)	ug	<0.20	<0.20	<0.20	0.20	0.040	<0.50	0.50	0.10	4750416
Front Half Chromium (Cr)	ug	35.2	43.0	37.6	0.60	0.10	15.2	1.5	0.25	4750416
Front Half Cobalt (Co)	ug	0.93	0.55	0.52	0.20	0.020	0.93	0.50	0.050	4750416
Front Half Lead (Pb)	ug	0.86	0.70	0.74	0.40	0.040	10.7	1.0	0.10	4750416
Front Half Manganese (Mn)	ug	16.1	20.6	27.4	1.5	0.10	126	3.8	0.25	4750416
Front Half Nickel (Ni)	ug	21.4	19.6	19.5	1.0	0.20	11.6	2.5	0.50	4750416
Front Half Selenium (Se)	ug	<2.0	<2.0	<2.0	2.0	0.50	<5.0	5.0	1.3	4750416
Back Half Antimony (Sb)	ug	<0.40	<0.40	<0.40	0.40	0.080	<0.40	0.40	0.080	4746765
Back Half Arsenic (As)	ug	<0.40	<0.40	<0.40	0.40	0.080	0.99	0.40	0.080	4746765
Back Half Beryllium (Be)	ug	<0.10	<0.10	<0.10	0.10	0.10	<0.10	0.10	0.10	4746765
Back Half Cadmium (Cd)	ug	<0.10	<0.10	<0.10	0.10	0.060	<0.10	0.10	0.060	4746765
Back Half Chromium (Cr)	ug	4.65	3.70	3.97	0.30	0.14	131	0.30	0.14	4746765
Back Half Cobalt (Co)	ug	0.31	<0.10	0.10	0.10	0.020	2.17	0.10	0.020	4746765
Back Half Lead (Pb)	ug	0.64	0.56	0.69	0.20	0.080	1.83	0.20	0.080	4746765
Back Half Manganese (Mn)	ug	17.9	11.2	37.8	0.50	0.12	106	0.50	0.12	4746765
Back Half Nickel (Ni)	ug	8.76	2.84	2.29	0.50	0.12	67.6	0.50	0.12	4746765
Back Half Selenium (Se)	ug	1.3	2.9	2.0	1.0	0.40	5.9	1.0	0.40	4746765

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

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A Bureau Veritas Group Company

Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

EPA M29 METALS (FRONT & BACK SEPARATE)

Maxxam ID		DKG476	DKG477			
Sampling Date		2016/10/26	2016/10/26			
COC Number		23261,22710	23261,22710			
	UNITS	**M5/29 QUENCH-R2**	**M5/29 QUENCH-R3**	**RDL**	**MDL**	**QC Batch**
Metals						
Front Half Antimony (Sb)	ug	<2.0	2.1	2.0	0.20	4750416
Front Half Arsenic (As)	ug	26.6	27.0	2.0	0.20	4750416
Front Half Beryllium (Be)	ug	<0.50	<0.50	0.50	0.10	4750416
Front Half Cadmium (Cd)	ug	<0.50	<0.50	0.50	0.10	4750416
Front Half Chromium (Cr)	ug	3.4	39.0	1.5	0.25	4750416
Front Half Cobalt (Co)	ug	0.53	1.46	0.50	0.050	4750416
Front Half Lead (Pb)	ug	8.6	8.9	1.0	0.10	4750416
Front Half Manganese (Mn)	ug	6.7	47.5	3.8	0.25	4750416
Front Half Nickel (Ni)	ug	4.1	32.2	2.5	0.50	4750416
Front Half Selenium (Se)	ug	<5.0	<5.0	5.0	1.3	4750416
Back Half Antimony (Sb)	ug	<0.40	<0.40	0.40	0.080	4746765
Back Half Arsenic (As)	ug	9.29	4.27	0.40	0.080	4746765
Back Half Beryllium (Be)	ug	<0.10	<0.10	0.10	0.10	4746765
Back Half Cadmium (Cd)	ug	<0.10	<0.10	0.10	0.060	4746765
Back Half Chromium (Cr)	ug	2.51	6.44	0.30	0.14	4746765
Back Half Cobalt (Co)	ug	0.30	0.21	0.10	0.020	4746765
Back Half Lead (Pb)	ug	0.77	0.84	0.20	0.080	4746765
Back Half Manganese (Mn)	ug	13.2	132	0.50	0.12	4746765
Back Half Nickel (Ni)	ug	2.56	12.1	0.50	0.12	4746765
Back Half Selenium (Se)	ug	3.5	3.1	1.0	0.40	4746765

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

EPA M29 METALS (FRONT & BACK SEPARATE)

Maxxam ID		DMT409	DMT416	DMT417			
Sampling Date		2016/10/25	2016/10/25	2016/10/25			
COC Number		23261,22710	23261,22710	23261,22710			
	UNITS	M5/29 FH- RINSE- PEC-R1	M5/29 FH- RINSE- PEC-R2	M5/29 FH- RINSE- PEC-R3	RDL	MDL	QC Batch
Metals							
Front Half Antimony (Sb)	ug	<0.80	<0.80	<0.80	0.80	0.080	4762094
Front Half Arsenic (As)	ug	<0.80	<0.80	1.14	0.80	0.080	4762094
Front Half Beryllium (Be)	ug	<0.20	<0.20	<0.20	0.20	0.040	4762094
Front Half Cadmium (Cd)	ug	<0.20	<0.20	<0.20	0.20	0.040	4762094
Front Half Chromium (Cr)	ug	9.41	13.5	2.56	0.60	0.10	4762094
Front Half Cobalt (Co)	ug	0.34	0.22	<0.20	0.20	0.020	4762094
Front Half Lead (Pb)	ug	0.59	0.59	<0.40	0.40	0.040	4762094
Front Half Manganese (Mn)	ug	6.0	3.5	2.1	1.5	0.10	4762094
Front Half Nickel (Ni)	ug	12.4	11.2	3.5	1.0	0.20	4762094
Front Half Selenium (Se)	ug	<2.0	<2.0	<2.0	2.0	0.50	4762094

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DMT418	DMT419	DMT420			
Sampling Date		2016/10/25	2016/10/25	2016/10/25			
COC Number		23261,22710	23261,22710	23261,22710			
	UNITS	M5/29 FH- RINSE-QUENCH- R1	M5/29 FH- RINSE-QUENCH- R2	M5/29 FH- RINSE-QUENCH- R3	RDL	MDL	QC Batch
Metals							
Front Half Antimony (Sb)	ug	<0.80	<0.80	<0.80	0.80	0.080	4762094
Front Half Arsenic (As)	ug	11.4	7.88	3.39	0.80	0.080	4762094
Front Half Beryllium (Be)	ug	<0.20	0.21	<0.20	0.20	0.040	4762094
Front Half Cadmium (Cd)	ug	0.47	<0.20	<0.20	0.20	0.040	4762094
Front Half Chromium (Cr)	ug	6.55	8.71	2.29	0.60	0.10	4762094
Front Half Cobalt (Co)	ug	0.63	0.58	<0.20	0.20	0.020	4762094
Front Half Lead (Pb)	ug	2.71	1.42	1.00	0.40	0.040	4762094
Front Half Manganese (Mn)	ug	2.7	7.7	9.1	1.5	0.10	4762094
Front Half Nickel (Ni)	ug	9.7	10.6	4.2	1.0	0.20	4762094
Front Half Selenium (Se)	ug	<2.0	<2.0	<2.0	2.0	0.50	4762094

RDL = Reportable Detection Limit
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Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

EPA M29 MERCURY (STACK SAMPLING TRAIN)

Maxxam ID		DKG394			DKG395			DKG396			
Sampling Date		2016/10/25			2016/10/25			2016/10/25			
COC Number		23261,22710			23261,22710			23261,22710			
	UNITS	M5/29 PEC-R1	RDL	MDL	M5/29 PEC-R2	RDL	MDL	M5/29 PEC-R3	RDL	MDL	QC Batch
Metals											
1B Mercury (Hg)	ug	<0.15	0.15	0.15	<0.015	0.015	0.015	<0.015	0.015	0.015	4750430
2B Mercury (Hg)	ug	0.19	0.16	0.032	0.19	0.17	0.034	0.16	0.16	0.032	4754312
3B Mercury (Hg)	ug	<0.023	0.023	0.0046	0.069	0.025	0.005	<0.025	0.025	0.005	4750856
3C Mercury (Hg)	ug	1.78	0.013	0.0026	1.01	0.013	0.0026	1.25	0.013	0.0026	4754482

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DKG474			DKG476			
Sampling Date		2016/10/26			2016/10/26			
COC Number		23261,22710			23261,22710			
	UNITS	M5/29 QUENCH-R1	RDL	MDL	M5/29 QUENCH-R2	RDL	MDL	QC Batch
Metals								
1B Mercury (Hg)	ug	0.039	0.015	0.015	<0.015	0.015	0.015	4750430
2B Mercury (Hg)	ug	<0.26	0.26	0.052	<0.36	0.36	0.072	4754312
3B Mercury (Hg)	ug	<0.025	0.025	0.005	<0.023	0.023	0.0046	4750856
3C Mercury (Hg)	ug	0.062	0.013	0.0026	0.050	0.013	0.0026	4754482

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DKG477		DMT409	DMT416			
Sampling Date		2016/10/26		2016/10/25	2016/10/25			
COC Number		23261,22710		23261,22710	23261,22710			
	UNITS	M5/29 QUENCH-R3	QC Batch	M5/29 FH- RINSE- PEC-R1	M5/29 FH- RINSE- PEC-R2	RDL	MDL	QC Batch
Metals								
1B Mercury (Hg)	ug	<0.015	4750430	<0.015	<0.015	0.015	0.015	4762091
2B Mercury (Hg)	ug	<0.35	4754312			0.35	0.07	
3B Mercury (Hg)	ug	<0.023	4750856			0.023	0.0046	
3C Mercury (Hg)	ug	0.043	4754482			0.013	0.0026	

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

EPA M29 MERCURY (STACK SAMPLING TRAIN)

Maxxam ID		DMT417	DMT418	DMT419			
Sampling Date		2016/10/25	2016/10/25	2016/10/25			
COC Number		23261,22710	23261,22710	23261,22710			
	UNITS	**M5/29 FH- RINSE- PEC- R3**	**M5/29 FH- RINSE- QUENCH- R1**	**M5/29 FH- RINSE- QUENCH- R2**	**RDL**	**MDL**	**QC Batch**
Metals							
1B Mercury (Hg)	ug	<0.015	<0.015	<0.015	0.015	0.015	4762091

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DMT420			
Sampling Date		2016/10/25			
COC Number		23261,22710			
	UNITS	**M5/29 FH- RINSE- QUENCH- R3**	**RDL**	**MDL**	**QC Batch**
Metals					
1B Mercury (Hg)	ug	<0.015	0.015	0.015	4762091

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

EPA M5 PARTICULATE MATTER (PM)

Maxxam ID		DKG394	DKG395	DKG396			
Sampling Date		2016/10/25	2016/10/25	2016/10/25			
COC Number		23261,22710	23261,22710	23261,22710			
	UNITS	**M5/29 PEC-R1**	**M5/29 PEC-R2**	**M5/29 PEC-R3**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse Particulate Weight in Acetone Rinse	mg	5.3	2.7	2.8	0.5	0.1	4740547
Front Half Particulate Weight on Filter	mg	2.60	2.70	1.60	0.30	0.060	4742831
Acetone Rinse Volume	ml	100	93	120	1	1	4740548

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DKG474	DKG476	DKG477			
Sampling Date		2016/10/26	2016/10/26	2016/10/26			
COC Number		23261,22710	23261,22710	23261,22710			
	UNITS	**M5/29 QUENCH-R1**	**M5/29 QUENCH-R2**	**M5/29 QUENCH-R3**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse Particulate Weight in Acetone Rinse	mg	136	18.3	309	0.5	0.1	4740547
Front Half Particulate Weight on Filter	mg	116	22.6	205	0.30	0.060	4742831
Acetone Rinse Volume	ml	91	85	110	1	1	4740548

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

Maxxam ID		DKG382	DKG383	DKG384			
Sampling Date		2016/10/26	2016/10/26	2016/10/26			
COC Number		23261,22710	23261,22710	23261,22710			
	UNITS	**M315 - FILT R1**	**M315 - FILT R3**	**M315 - FILT R4**	**RDL**	**MDL**	**QC Batch**
Front Half DCM Extractable Material	mg	8.20	9.50	8.10	0.50	N/A	4744594
Front Half Particulate Weight on Filter	mg	19.9	33.5	25.5	0.30	0.060	4744594

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

Maxxam ID		DKG386	DKG387			
Sampling Date		2016/10/26	2016/10/26			
COC Number		23261,22710	23261,22710			
	UNITS	**M315 - R1 ACE/TOL 2W/T**	**M315 - R3 ACE/TOL 2W/T**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse DCM Extractable Material	mg	8.3	10.4	0.5	N/A	4744595
Acetone Rinse Particulate Weight in Acetone Rinse	mg	114	80.3	0.5	0.1	4744595
Acetone Rinse Volume	ml	48	58	1	1	4757313

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

Maxxam ID		DKG388	DKG390			
Sampling Date		2016/10/26	2016/10/26			
COC Number		23261,22710	23261,22710			
	UNITS	**M315 - R4 ACE/TOL 2W/T**	**M315 - R1 BH IMP 3W/S**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse DCM Extractable Material	mg	8.6		0.5	N/A	4744595
Back Half DCM Extractable Material	mg		2.6	0.5	N/A	4746782
Back Half DCM Extractable Material in Rinse	mg		6.5	0.5	N/A	4746782
Acetone Rinse Particulate Weight in Acetone Rinse	mg	7.7		0.5	0.1	4744595
Acetone Rinse Volume	ml	41		1	1	4757313

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

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RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

Maxxam ID		DKG391	DKG392			
Sampling Date		2016/10/26	2016/10/26			
COC Number		23261,22710	23261,22710			
	UNITS	**M315 - R3 BH IMP 3W/S**	**M315 - R4 BH IMP 3W/S**	**RDL**	**MDL**	**QC Batch**
Back Half DCM Extractable Material	mg	2.1	2.1	0.5	N/A	4746782
Back Half DCM Extractable Material in Rinse	mg	5.0	3.4	0.5	N/A	4746782

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

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Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

TEST SUMMARY

Maxxam ID: DKG382 **Collected:** 2016/10/26
Sample ID: M315 - FILT R1 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4744594	N/A	2016/11/14	Brenda Moore

Maxxam ID: DKG383 **Collected:** 2016/10/26
Sample ID: M315 - FILT R3 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4744594	N/A	2016/11/14	Brenda Moore

Maxxam ID: DKG384 **Collected:** 2016/10/26
Sample ID: M315 - FILT R4 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4744594	N/A	2016/11/14	Brenda Moore

Maxxam ID: DKG386 **Collected:** 2016/10/26
Sample ID: M315 - R1 ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4744595	2016/11/11	2016/11/15	Farag Farag
Final Volume of Acetone Probe Rinse		4757313	N/A	2016/11/21	Brenda Moore

Maxxam ID: DKG387 **Collected:** 2016/10/26
Sample ID: M315 - R3 ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4744595	2016/11/11	2016/11/15	Farag Farag
Final Volume of Acetone Probe Rinse		4757313	N/A	2016/11/21	Brenda Moore

Maxxam ID: DKG388 **Collected:** 2016/10/26
Sample ID: M315 - R4 ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4744595	2016/11/11	2016/11/15	Farag Farag
Final Volume of Acetone Probe Rinse		4757313	N/A	2016/11/21	Brenda Moore

Maxxam ID: DKG390 **Collected:** 2016/10/26
Sample ID: M315 - R1 BH IMP 3W/S **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4746782	2016/11/14	2016/11/18	Farag Farag

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

TEST SUMMARY

Maxxam ID: DKG391
Sample ID: M315 - R3 BH IMP 3W/S
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4746782	2016/11/14	2016/11/18	Farag Farag

Maxxam ID: DKG392
Sample ID: M315 - R4 BH IMP 3W/S
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4746782	2016/11/14	2016/11/18	Farag Farag

Maxxam ID: DKG394
Sample ID: M5/29 PEC- R1
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/16	2016/11/17	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4740547	2016/11/09	2016/11/15	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4742831	N/A	2016/11/11	Brenda Moore
Final Volume of Acetone Probe Rinse		4740548	N/A	2016/11/11	Farag Farag

Maxxam ID: DKG394 Dup
Sample ID: M5/29 PEC- R1
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha

Maxxam ID: DKG395
Sample ID: M5/29 PEC- R2
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/16	2016/11/17	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4740547	2016/11/09	2016/11/15	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4742831	N/A	2016/11/11	Brenda Moore
Final Volume of Acetone Probe Rinse		4740548	N/A	2016/11/11	Farag Farag

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Report Date: 2016/11/25

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

TEST SUMMARY

Maxxam ID: DKG395 Dup
Sample ID: M5/29 PEC- R2
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/17	2016/11/21	Ron Morrison

Maxxam ID: DKG396
Sample ID: M5/29 PEC- R3
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/16	2016/11/17	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4740547	2016/11/09	2016/11/15	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4742831	N/A	2016/11/11	Brenda Moore
Final Volume of Acetone Probe Rinse		4740548	N/A	2016/11/11	Farag Farag

Maxxam ID: DKG396 Dup
Sample ID: M5/29 PEC- R3
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison

Maxxam ID: DKG474
Sample ID: M5/29 QUENCH- R1
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/16	2016/11/17	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4740547	2016/11/09	2016/11/15	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4742831	N/A	2016/11/11	Brenda Moore
Final Volume of Acetone Probe Rinse		4740548	N/A	2016/11/11	Farag Farag

Maxxam ID: DKG474 Dup
Sample ID: M5/29 QUENCH- R1
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison

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Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

TEST SUMMARY

Maxxam ID: DKG476
Sample ID: M5/29 QUENCH- R2
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/16	2016/11/17	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4740547	2016/11/09	2016/11/15	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4742831	N/A	2016/11/11	Brenda Moore
Final Volume of Acetone Probe Rinse		4740548	N/A	2016/11/11	Farag Farag

Maxxam ID: DKG477
Sample ID: M5/29 QUENCH- R3
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4754482	2016/11/18	2016/11/21	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4754312	2016/11/18	2016/11/21	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4750856	2016/11/16	2016/11/17	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4750430	2016/11/16	2016/11/17	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4746765	2016/11/14	2016/11/14	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4750416	2016/11/16	2016/11/23	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4740547	2016/11/09	2016/11/15	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4742831	N/A	2016/11/11	Brenda Moore
Final Volume of Acetone Probe Rinse		4740548	N/A	2016/11/11	Farag Farag

Maxxam ID: DMT409
Sample ID: M5/29 FH- RINSE- PEC- R1
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

Maxxam ID: DMT409 Dup
Sample ID: M5/29 FH- RINSE- PEC- R1
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

Maxxam ID: DMT416
Sample ID: M5/29 FH- RINSE- PEC- R2
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

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Report Date: 2016/11/25

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

TEST SUMMARY

Maxxam ID: DMT416 Dup
Sample ID: M5/29 FH- RINSE- PEC- R2
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison

Maxxam ID: DMT417
Sample ID: M5/29 FH- RINSE- PEC- R3
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

Maxxam ID: DMT418
Sample ID: M5/29 FH- RINSE- QUENCH- R1
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

Maxxam ID: DMT419
Sample ID: M5/29 FH- RINSE- QUENCH- R2
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

Maxxam ID: DMT420
Sample ID: M5/29 FH- RINSE- QUENCH- R3
Matrix: Stack Sampling Train

Collected: 2016/10/25
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 1B in Filter + Rinse (M29)	CV/AA	4762091	2016/11/23	2016/11/21	Ron Morrison
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4762094	2016/11/18	2016/11/23	Nan Raykha

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GENERAL COMMENTS

Sample DKG382 [M315 - FILT R1] : LPC Loose particulate material in the petri dish

Sample DKG383 [M315 - FILT R3] : LPC Loose particulate material in the petri dish

Sample DKG384 [M315 - FILT R4] : LPC Loose particulate material in the petri dish

Sample DKG474 [M5/29 QUENCH- R1] : LPC Loose particulate material in the petri dish
WS4746765: The Hg cut for this sample was analyzed on 2016-11-15 to confirm data (Cr data obtained =125 ug, Mn = 104 ug))

Sample DKG476 [M5/29 QUENCH- R2] : LPC Loose particulate material in the petri dish

Sample DKG477 [M5/29 QUENCH- R3] : LPC Loose particulate material in the petri dish

EPA M29 METALS (FRONT & BACK SEPARATE)

Metals F.H. in Filter + Rinses (6020A): Extra dilution was required for some samples due to the matrix.
Post digestion duplicate and spike were done on sample DKG394.
Metals B.H. in H2O2/HNO3 Imp.(6020A): Extra 2x dilution was required for all samples due to the matrix.
Post digestion duplicate and spike were done on sample DKG394.
Metals F.H. in Filter + Rinses (6020A): Post digestion duplicate and spike were done on sample DMT409.
CCV recovery for Se range from 99.5% to 89.8%, data for Se may be slightly biased low

EPA M29 MERCURY (STACK SAMPLING TRAIN)

Mercury 1B in Filter + Rinse (M29): Due to lab error this front half fraction contains nitric rinses from the backhalf impinger.

Mercury 1B in Filter + Rinse (M29): Due to lab error this FH fraction contains nitric rinse only from the front half.

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
4740547	FF	Method Blank	Acetone Rinse Particulate Weight in Acetone	2016/11/15	<0.5		mg	
4744595	FF	Method Blank	Acetone Rinse DCM Extractable Material	2016/11/15	7.60		mg	
			Acetone Rinse Particulate Weight in Acetone	2016/11/15	<0.5		mg	
4746765	N_R	Matrix Spike(DKG394)	Back Half Antimony (Sb)	2016/11/14		98	%	70 - 130
			Back Half Arsenic (As)	2016/11/14		96	%	70 - 130
			Back Half Beryllium (Be)	2016/11/14		98	%	70 - 130
			Back Half Cadmium (Cd)	2016/11/14		97	%	70 - 130
			Back Half Chromium (Cr)	2016/11/14		94	%	70 - 130
			Back Half Cobalt (Co)	2016/11/14		97	%	70 - 130
			Back Half Lead (Pb)	2016/11/14		101	%	70 - 130
			Back Half Manganese (Mn)	2016/11/14		96	%	70 - 130
			Back Half Nickel (Ni)	2016/11/14		95	%	70 - 130
			Back Half Selenium (Se)	2016/11/14		97	%	70 - 130
4746765	N_R	MS/MSD RPD	Back Half Antimony (Sb)	2016/11/14	2.1		%	20
			Back Half Arsenic (As)	2016/11/14	1.0		%	20
			Back Half Beryllium (Be)	2016/11/14	0		%	20
			Back Half Cadmium (Cd)	2016/11/14	1.0		%	20
			Back Half Chromium (Cr)	2016/11/14	2.1		%	20
			Back Half Cobalt (Co)	2016/11/14	2.0		%	20
			Back Half Lead (Pb)	2016/11/14	0		%	20
			Back Half Manganese (Mn)	2016/11/14	3.1		%	20
			Back Half Nickel (Ni)	2016/11/14	1.0		%	20
			Back Half Selenium (Se)	2016/11/14	1.0		%	20
4746765	N_R	Spiked Blank	Back Half Antimony (Sb)	2016/11/14		108	%	85 - 115
			Back Half Arsenic (As)	2016/11/14		101	%	85 - 115
			Back Half Beryllium (Be)	2016/11/14		105	%	85 - 115
			Back Half Cadmium (Cd)	2016/11/14		104	%	85 - 115
			Back Half Chromium (Cr)	2016/11/14		105	%	85 - 115
			Back Half Cobalt (Co)	2016/11/14		104	%	85 - 115
			Back Half Lead (Pb)	2016/11/14		103	%	85 - 115
			Back Half Manganese (Mn)	2016/11/14		109	%	85 - 115
			Back Half Nickel (Ni)	2016/11/14		104	%	85 - 115
			Back Half Selenium (Se)	2016/11/14		97	%	85 - 115
4746765	N_R	RPD	Back Half Antimony (Sb)	2016/11/14	1.5		%	20
			Back Half Arsenic (As)	2016/11/14	0.80		%	20
			Back Half Beryllium (Be)	2016/11/14	0.40		%	20
			Back Half Cadmium (Cd)	2016/11/14	0.39		%	20
			Back Half Chromium (Cr)	2016/11/14	0.13		%	20
			Back Half Cobalt (Co)	2016/11/14	1.1		%	20
			Back Half Lead (Pb)	2016/11/14	1.2		%	20
			Back Half Manganese (Mn)	2016/11/14	0.75		%	20
			Back Half Nickel (Ni)	2016/11/14	1.5		%	20
			Back Half Selenium (Se)	2016/11/14	1.2		%	20
4746765	N_R	Method Blank	Back Half Antimony (Sb)	2016/11/14	<0.20		ug	
			Back Half Arsenic (As)	2016/11/14	<0.20		ug	
			Back Half Beryllium (Be)	2016/11/14	<0.050		ug	
			Back Half Cadmium (Cd)	2016/11/14	<0.050		ug	
			Back Half Chromium (Cr)	2016/11/14	<0.15		ug	
			Back Half Cobalt (Co)	2016/11/14	<0.050		ug	
			Back Half Lead (Pb)	2016/11/14	<0.10		ug	
			Back Half Manganese (Mn)	2016/11/14	<0.25		ug	
			Back Half Nickel (Ni)	2016/11/14	<0.25		ug	
			Back Half Selenium (Se)	2016/11/14	<0.50		ug	
4746765	N_R	RPD - Sample/Sample Dup	Back Half Antimony (Sb)	2016/11/14	NC		%	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 Arsenic (As)	2016/11/14	NC		%	20
			Back Half Beryllium (Be)	2016/11/14	NC		%	20
			Back Half Cadmium (Cd)	2016/11/14	NC		%	20
			Back Half Chromium (Cr)	2016/11/14	2.0		%	20
			Back Half Cobalt (Co)	2016/11/14	NC		%	20
			Back Half Lead (Pb)	2016/11/14	NC		%	20
			Back Half Manganese (Mn)	2016/11/14	1.4		%	20
			Back Half Nickel (Ni)	2016/11/14	0.69		%	20
			Back Half Selenium (Se)	2016/11/14	NC		%	20
4746782	FF	Method Blank	Back Half DCM Extractable Material	2016/11/18	0.6, RDL=0.5		mg	
			Back Half DCM Extractable Material in Rinse	2016/11/18	<0.5		mg	
4750416	N_R	Matrix Spike(DKG394)	Front Half Antimony (Sb)	2016/11/23		103	%	70 - 130
			Front Half Arsenic (As)	2016/11/23		98	%	70 - 130
			Front Half Beryllium (Be)	2016/11/23		99	%	70 - 130
			Front Half Cadmium (Cd)	2016/11/23		102	%	70 - 130
			Front Half Chromium (Cr)	2016/11/23		108	%	70 - 130
			Front Half Cobalt (Co)	2016/11/23		103	%	70 - 130
			Front Half Lead (Pb)	2016/11/23		103	%	70 - 130
			Front Half Manganese (Mn)	2016/11/23		105	%	70 - 130
			Front Half Nickel (Ni)	2016/11/23		100	%	70 - 130
			Front Half Selenium (Se)	2016/11/23		100	%	70 - 130
4750416	N_R	MS/MSD RPD	Front Half Antimony (Sb)	2016/11/23	2.0		%	20
			Front Half Arsenic (As)	2016/11/23	2.0		%	20
			Front Half Beryllium (Be)	2016/11/23	6.3		%	20
			Front Half Cadmium (Cd)	2016/11/23	3.0		%	20
			Front Half Chromium (Cr)	2016/11/23	2.7		%	20
			Front Half Cobalt (Co)	2016/11/23	0.98		%	20
			Front Half Lead (Pb)	2016/11/23	2.9		%	20
			Front Half Manganese (Mn)	2016/11/23	3.7		%	20
			Front Half Nickel (Ni)	2016/11/23	3.0		%	20
			Front Half Selenium (Se)	2016/11/23	2.0		%	20
4750416	N_R	Spiked Blank	Front Half Antimony (Sb)	2016/11/23		99	%	85 - 115
			Front Half Arsenic (As)	2016/11/23		99	%	85 - 115
			Front Half Beryllium (Be)	2016/11/23		93	%	85 - 115
			Front Half Cadmium (Cd)	2016/11/23		99	%	85 - 115
			Front Half Chromium (Cr)	2016/11/23		102	%	85 - 115
			Front Half Cobalt (Co)	2016/11/23		101	%	85 - 115
			Front Half Lead (Pb)	2016/11/23		102	%	85 - 115
			Front Half Manganese (Mn)	2016/11/23		101	%	85 - 115
			Front Half Nickel (Ni)	2016/11/23		100	%	85 - 115
			Front Half Selenium (Se)	2016/11/23		98	%	85 - 115
4750416	N_R	RPD	Front Half Antimony (Sb)	2016/11/23	0.31		%	20
			Front Half Arsenic (As)	2016/11/23	3.4		%	20
			Front Half Beryllium (Be)	2016/11/23	4.7		%	20
			Front Half Cadmium (Cd)	2016/11/23	4.1		%	20
			Front Half Chromium (Cr)	2016/11/23	1.4		%	20
			Front Half Cobalt (Co)	2016/11/23	1.2		%	20
			Front Half Lead (Pb)	2016/11/23	0.41		%	20
			Front Half Manganese (Mn)	2016/11/23	0.72		%	20
			Front Half Nickel (Ni)	2016/11/23	1.2		%	20
			Front Half Selenium (Se)	2016/11/23	0.68		%	20
4750416	N_R	Method Blank	Front Half Antimony (Sb)	2016/11/23	<0.80		ug	
			Front Half Arsenic (As)	2016/11/23	<0.80		ug	

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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 Beryllium (Be)	2016/11/23	<0.20		ug	
			Front Half Cadmium (Cd)	2016/11/23	<0.20		ug	
			Front Half Chromium (Cr)	2016/11/23	<0.60		ug	
			Front Half Cobalt (Co)	2016/11/23	<0.20		ug	
			Front Half Lead (Pb)	2016/11/23	<0.40		ug	
			Front Half Manganese (Mn)	2016/11/23	<1.5		ug	
			Front Half Nickel (Ni)	2016/11/23	<1.0		ug	
			Front Half Selenium (Se)	2016/11/23	<2.0		ug	
4750416	N_R	RPD - Sample/Sample Dup	Front Half Antimony (Sb)	2016/11/23	NC		%	20
			Front Half Arsenic (As)	2016/11/23	NC		%	20
			Front Half Beryllium (Be)	2016/11/23	NC		%	20
			Front Half Cadmium (Cd)	2016/11/23	NC		%	20
			Front Half Chromium (Cr)	2016/11/23	2.5		%	20
			Front Half Cobalt (Co)	2016/11/23	NC		%	20
			Front Half Lead (Pb)	2016/11/23	NC		%	20
			Front Half Manganese (Mn)	2016/11/23	2.8		%	20
			Front Half Nickel (Ni)	2016/11/23	2.2		%	20
			Front Half Selenium (Se)	2016/11/23	NC		%	20
4750430	RON	Reagent Blank	1B Mercury (Hg)	2016/11/17	<0.015		ug	
4750430	RON	Matrix Spike(DKG395)	1B Mercury (Hg)	2016/11/17		101	%	85 - 115
4750430	RON	MS/MSD RPD	1B Mercury (Hg)	2016/11/21	1.7		%	20
4750430	RON	Spiked Blank	1B Mercury (Hg)	2016/11/17		99	%	90 - 110
4750430	RON	RPD	1B Mercury (Hg)	2016/11/21	1.3		%	20
4750430	RON	Method Blank	1B Mercury (Hg)	2016/11/17	<0.015		ug	
4750430	RON	RPD - Sample/Sample Dup	1B Mercury (Hg)	2016/11/21	NC		%	20
4750856	RON	Reagent Blank	3B Mercury (Hg)	2016/11/17	<0.013		ug	
4750856	RON	Matrix Spike(DKG395)	3B Mercury (Hg)	2016/11/17		97	%	85 - 115
4750856	RON	MS/MSD RPD	3B Mercury (Hg)	2016/11/17	0.92		%	20
4750856	RON	Spiked Blank	3B Mercury (Hg)	2016/11/17		99	%	90 - 110
4750856	RON	RPD	3B Mercury (Hg)	2016/11/17	0.91		%	20
4750856	RON	Method Blank	3B Mercury (Hg)	2016/11/17	<0.013		ug	
4750856	RON	RPD - Sample/Sample Dup	3B Mercury (Hg)	2016/11/17	NC		%	20
4754312	RON	Matrix Spike(DKG396)	2B Mercury (Hg)	2016/11/21		105	%	85 - 115
4754312	RON	MS/MSD RPD	2B Mercury (Hg)	2016/11/21	1.4		%	20
4754312	RON	Spiked Blank	2B Mercury (Hg)	2016/11/21		105	%	90 - 110
4754312	RON	RPD	2B Mercury (Hg)	2016/11/21	0.19		%	20
4754312	RON	Method Blank	2B Mercury (Hg)	2016/11/21	<0.015		ug	
4754312	RON	RPD - Sample/Sample Dup	2B Mercury (Hg)	2016/11/21	NC		%	20
4754482	RON	Reagent Blank	3C Mercury (Hg)	2016/11/21	<0.013		ug	
4754482	RON	Matrix Spike(DKG474)	3C Mercury (Hg)	2016/11/21		98	%	85 - 115
4754482	RON	MS/MSD RPD	3C Mercury (Hg)	2016/11/21	0.51		%	20
4754482	RON	Spiked Blank	3C Mercury (Hg)	2016/11/21		104	%	90 - 110
4754482	RON	RPD	3C Mercury (Hg)	2016/11/21	1.8		%	20
4754482	RON	Method Blank	3C Mercury (Hg)	2016/11/21	<0.013		ug	
4754482	RON	RPD - Sample/Sample Dup	3C Mercury (Hg)	2016/11/21	NC		%	20
4762091	RON	Reagent Blank	1B Mercury (Hg)	2016/11/21	<0.015		ug	
4762091	RON	Matrix Spike(DMT416)	1B Mercury (Hg)	2016/11/21		104	%	85 - 115
4762091	RON	MS/MSD RPD	1B Mercury (Hg)	2016/11/21	1.2		%	20
4762091	RON	Spiked Blank	1B Mercury (Hg)	2016/11/21		106	%	90 - 110
4762091	RON	RPD	1B Mercury (Hg)	2016/11/21	2.0		%	20
4762091	RON	Method Blank	1B Mercury (Hg)	2016/11/21	<0.015		ug	
4762091	RON	RPD - Sample/Sample Dup	1B Mercury (Hg)	2016/11/21	NC		%	20
4762094	N_R	Matrix Spike(DMT409)	Front Half Antimony (Sb)	2016/11/23		103	%	70 - 130
			Front Half Arsenic (As)	2016/11/23		97	%	70 - 130

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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 Beryllium (Be)	2016/11/23		104	%	70 - 130
			Front Half Cadmium (Cd)	2016/11/23		99	%	70 - 130
			Front Half Chromium (Cr)	2016/11/23		94	%	70 - 130
			Front Half Cobalt (Co)	2016/11/23		100	%	70 - 130
			Front Half Lead (Pb)	2016/11/23		93	%	70 - 130
			Front Half Manganese (Mn)	2016/11/23		100	%	70 - 130
			Front Half Nickel (Ni)	2016/11/23		103	%	70 - 130
			Front Half Selenium (Se)	2016/11/23		96	%	70 - 130
4762094	N_R	MS/MSD RPD	Front Half Antimony (Sb)	2016/11/23	5.0		%	20
			Front Half Arsenic (As)	2016/11/23	4.2		%	20
			Front Half Beryllium (Be)	2016/11/23	4.9		%	20
			Front Half Cadmium (Cd)	2016/11/23	1.0		%	20
			Front Half Chromium (Cr)	2016/11/23	2.2		%	20
			Front Half Cobalt (Co)	2016/11/23	0		%	20
			Front Half Lead (Pb)	2016/11/23	4.4		%	20
			Front Half Manganese (Mn)	2016/11/23	1.0		%	20
			Front Half Nickel (Ni)	2016/11/23	6.0		%	20
			Front Half Selenium (Se)	2016/11/23	1.0		%	20
4762094	N_R	Spiked Blank	Front Half Antimony (Sb)	2016/11/23		105	%	85 - 115
			Front Half Arsenic (As)	2016/11/23		98	%	85 - 115
			Front Half Beryllium (Be)	2016/11/23		101	%	85 - 115
			Front Half Cadmium (Cd)	2016/11/23		106	%	85 - 115
			Front Half Chromium (Cr)	2016/11/23		101	%	85 - 115
			Front Half Cobalt (Co)	2016/11/23		106	%	85 - 115
			Front Half Lead (Pb)	2016/11/23		92	%	85 - 115
			Front Half Manganese (Mn)	2016/11/23		101	%	85 - 115
			Front Half Nickel (Ni)	2016/11/23		105	%	85 - 115
			Front Half Selenium (Se)	2016/11/23		101	%	85 - 115
4762094	N_R	RPD	Front Half Antimony (Sb)	2016/11/23	11		%	20
			Front Half Arsenic (As)	2016/11/23	2.3		%	20
			Front Half Beryllium (Be)	2016/11/23	0.74		%	20
			Front Half Cadmium (Cd)	2016/11/23	8.5		%	20
			Front Half Chromium (Cr)	2016/11/23	0.53		%	20
			Front Half Cobalt (Co)	2016/11/23	5.6		%	20
			Front Half Lead (Pb)	2016/11/23	1.4		%	20
			Front Half Manganese (Mn)	2016/11/23	2.6		%	20
			Front Half Nickel (Ni)	2016/11/23	4.4		%	20
			Front Half Selenium (Se)	2016/11/23	1.1		%	20
4762094	N_R	Method Blank	Front Half Antimony (Sb)	2016/11/23	<0.80		ug	
			Front Half Arsenic (As)	2016/11/23	<0.80		ug	
			Front Half Beryllium (Be)	2016/11/23	<0.20		ug	
			Front Half Cadmium (Cd)	2016/11/23	<0.20		ug	
			Front Half Chromium (Cr)	2016/11/23	<0.60		ug	
			Front Half Cobalt (Co)	2016/11/23	<0.20		ug	
			Front Half Lead (Pb)	2016/11/23	<0.40		ug	
			Front Half Manganese (Mn)	2016/11/23	<1.5		ug	
			Front Half Nickel (Ni)	2016/11/23	<1.0		ug	
			Front Half Selenium (Se)	2016/11/23	<2.0		ug	
4762094	N_R	RPD - Sample/Sample Dup	Front Half Antimony (Sb)	2016/11/23	NC		%	20
			Front Half Arsenic (As)	2016/11/23	NC		%	20
			Front Half Beryllium (Be)	2016/11/23	NC		%	20
			Front Half Cadmium (Cd)	2016/11/23	NC		%	20
			Front Half Chromium (Cr)	2016/11/23	7.1		%	20
			Front Half Cobalt (Co)	2016/11/23	NC		%	20

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Maxxam Job #: B6O2329
Report Date: 2016/11/25

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

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Front Half Lead (Pb)	2016/11/23	NC		%	20
			Front Half Manganese (Mn)	2016/11/23	NC		%	20
			Front Half Nickel (Ni)	2016/11/23	4.1		%	20
			Front Half Selenium (Se)	2016/11/23	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Reagent Blank: A blank matrix containing all reagents used in the analytical procedure. Used to determine any analytical contamination.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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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

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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Methods 0010/23

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Your Project #: 106377/ (16-167)
Your C.O.C. #: 23262

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/12/02
Report #: R4271803
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6O1812
Received: 2016/11/07, 18:30

Sample Matrix: Stack Sampling Train
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
SVOCs in MM5 SamplingTrain (EPA0010)	5	2016/11/09	2016/11/24	BRL SOP-00200	EPA 8270D/M0010 m
SVOCs in MM5 SamplingTrain (EPA0010)	1	2016/11/09	2016/11/25	BRL SOP-00200	EPA 8270D/M0010 m
2,3,7,8-TCDF Confirmation (M23)	4	N/A	2016/12/01	BRL SOP-00404	EPA M23/23A m
Dioxins/Furans in Air (Method 23)	6	2016/11/09	2016/11/30	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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Maxxam
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Your Project #: 106377/ (16-167)
Your C.O.C. #: 23262

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
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Report Date: 2016/12/02
Report #: R4271803
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6O1812
Received: 2016/11/07, 18:30

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
02 Dec 2016 13:54:10

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 #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC905							
Sampling Date		2016/10/28							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- PEC-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		4767357
1,2,3,7,8-Penta CDD *	pg	<3.2	3.2	30	6.0	1.00	3.20		4767357
1,2,3,4,7,8-Hexa CDD *	pg	<3.2	3.2	30	6.0	0.100	0.320		4767357
1,2,3,6,7,8-Hexa CDD *	pg	<3.2	3.2	30	6.0	0.100	0.320		4767357
1,2,3,7,8,9-Hexa CDD *	pg	<2.9	2.9	30	6.0	0.100	0.290		4767357
1,2,3,4,6,7,8-Hepta CDD *	pg	5.6	3.1	30	9.0	0.0100	0.0560		4767357
Total Tetra CDD *	pg	<3.4	3.4	30	N/A			0	4767357
Total Penta CDD *	pg	<3.2	3.2	30	N/A			0	4767357
Total Hexa CDD *	pg	<13 (1)	13	30	N/A			0	4767357
Total Hepta CDD *	pg	13.1	3.1	30	N/A			2	4767357
2,3,7,8-Tetra CDF **	pg	7.4	3.5	30	6.0	0.100	0.740		4767357
1,2,3,7,8-Penta CDF **	pg	<4.3	4.3	30	6.0	0.0300	0.129		4767357
2,3,4,7,8-Penta CDF **	pg	<4.3	4.3	30	6.0	0.300	1.29		4767357
1,2,3,4,7,8-Hexa CDF **	pg	<2.9	2.9	30	6.0	0.100	0.290		4767357
1,2,3,6,7,8-Hexa CDF **	pg	<2.7	2.7	30	6.0	0.100	0.270		4767357
2,3,4,6,7,8-Hexa CDF **	pg	<3.0	3.0	30	6.0	0.100	0.300		4767357
1,2,3,7,8,9-Hexa CDF **	pg	<3.2	3.2	30	6.0	0.100	0.320		4767357
1,2,3,4,6,7,8-Hepta CDF **	pg	4.1	2.8	30	9.0	0.0100	0.0410		4767357
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.3	3.3	30	6.0	0.0100	0.0330		4767357
Total Tetra CDF **	pg	17.0	3.5	30	N/A			3	4767357
Total Penta CDF **	pg	<4.3	4.3	30	N/A			0	4767357
Total Hexa CDF **	pg	<2.9	2.9	30	N/A			0	4767357
Total Hepta CDF **	pg	4.1	3.0	30	N/A			1	4767357
TOTAL TOXIC EQUIVALENCY	pg						11.0		

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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Maxxam Job #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC905							
Sampling Date		2016/10/28							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- PEC-R1**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Surrogate Recovery (%)									
C13-1234678 HeptaCDD *	%	79							4767357
C13-1234678 HeptaCDF **	%	72							4767357
C13-123478 HexaCDD *	%	106							4767357
C13-123478 HexaCDF **	%	89							4767357
C13-1234789 HeptaCDF **	%	98							4767357
C13-123678 HexaCDD *	%	94							4767357
C13-123678 HexaCDF **	%	84							4767357
C13-12378 PentaCDD *	%	81							4767357
C13-12378 PentaCDF **	%	89							4767357
C13-123789 HexaCDF **	%	66							4767357
C13-23478 PentaCDF **	%	102							4767357
C13-2378 TetraCDD *	%	106							4767357
C13-2378 TetraCDF **	%	89							4767357
C13-Octachlorodibenzo-p-Dioxin	%	75							4767357
Cl37-2378 TetraCDD *	%	101							4767357

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 #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC906							
Sampling Date		2016/10/28							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- PEC-R2**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Dioxins & Furans									
2,3,7,8-Tetra CDD *	pg	<3.7	3.7	30	6.0	1.00	3.70		4767357
1,2,3,7,8-Penta CDD *	pg	<3.8	3.8	30	6.0	1.00	3.80		4767357
1,2,3,4,7,8-Hexa CDD *	pg	<3.3	3.3	30	6.0	0.100	0.330		4767357
1,2,3,6,7,8-Hexa CDD *	pg	<3.3	3.3	30	6.0	0.100	0.330		4767357
1,2,3,7,8,9-Hexa CDD *	pg	<3.0	3.0	30	6.0	0.100	0.300		4767357
1,2,3,4,6,7,8-Hepta CDD *	pg	6.0	4.0	30	9.0	0.0100	0.0600		4767357
Total Tetra CDD *	pg	17.5	3.7	30	N/A			2	4767357
Total Penta CDD *	pg	<14 (1)	14	30	N/A			0	4767357
Total Hexa CDD *	pg	5.3	3.2	30	N/A			1	4767357
Total Hepta CDD *	pg	6.0	4.0	30	N/A			1	4767357
2,3,7,8-Tetra CDF **	pg	36.0	3.6	30	6.0	0.100	3.60		4767357
1,2,3,7,8-Penta CDF **	pg	4.5	3.9	30	6.0	0.0300	0.135		4767357
2,3,4,7,8-Penta CDF **	pg	9.3	3.9	30	6.0	0.300	2.79		4767357
1,2,3,4,7,8-Hexa CDF **	pg	17.5	3.8	30	6.0	0.100	1.75		4767357
1,2,3,6,7,8-Hexa CDF **	pg	5.5	3.6	30	6.0	0.100	0.550		4767357
2,3,4,6,7,8-Hexa CDF **	pg	5.5	4.0	30	6.0	0.100	0.550		4767357
1,2,3,7,8,9-Hexa CDF **	pg	<4.2	4.2	30	6.0	0.100	0.420		4767357
1,2,3,4,6,7,8-Hepta CDF **	pg	15.1	2.6	30	9.0	0.0100	0.151		4767357
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.1	3.1	30	6.0	0.0100	0.0310		4767357
Total Tetra CDF **	pg	103	3.6	30	N/A			8	4767357
Total Penta CDF **	pg	79.7	3.9	30	N/A			5	4767357
Total Hexa CDF **	pg	45.2	3.9	30	N/A			4	4767357
Total Hepta CDF **	pg	15.1	2.8	30	N/A			1	4767357
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	22.1	3.5	30	N/A	0.100	2.21		4775791
TOTAL TOXIC EQUIVALENCY	pg						17.1		

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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Maxxam Job #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC906							
Sampling Date		2016/10/28							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- PEC-R2**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	100							4775791
C13-1234678 HeptaCDD *	%	70							4767357
C13-1234678 HeptaCDF **	%	68							4767357
C13-123478 HexaCDD *	%	104							4767357
C13-123478 HexaCDF **	%	97							4767357
C13-1234789 HeptaCDF **	%	97							4767357
C13-123678 HexaCDD *	%	91							4767357
C13-123678 HexaCDF **	%	75							4767357
C13-12378 PentaCDD *	%	80							4767357
C13-12378 PentaCDF **	%	87							4767357
C13-123789 HexaCDF **	%	67							4767357
C13-23478 PentaCDF **	%	100							4767357
C13-2378 TetraCDD *	%	111							4767357
C13-2378 TetraCDF **	%	92							4767357
C13-Octachlorodibenzo-p-Dioxin	%	74							4767357
Cl37-2378 TetraCDD *	%	97							4767357

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 #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC907							
Sampling Date		2016/10/28							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- PEC-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		4767357
1,2,3,7,8-Penta CDD *	pg	<3.0	3.0	30	6.0	1.00	3.00		4767357
1,2,3,4,7,8-Hexa CDD *	pg	<3.0	3.0	30	6.0	0.100	0.300		4767357
1,2,3,6,7,8-Hexa CDD *	pg	<3.0	3.0	30	6.0	0.100	0.300		4767357
1,2,3,7,8,9-Hexa CDD *	pg	<2.8	2.8	30	6.0	0.100	0.280		4767357
1,2,3,4,6,7,8-Hepta CDD *	pg	5.0	3.6	30	9.0	0.0100	0.0500		4767357
Total Tetra CDD *	pg	<4.7 (1)	4.7	30	N/A			0	4767357
Total Penta CDD *	pg	<3.0	3.0	30	N/A			0	4767357
Total Hexa CDD *	pg	<7.8 (1)	7.8	30	N/A			0	4767357
Total Hepta CDD *	pg	5.0	3.6	30	N/A			1	4767357
2,3,7,8-Tetra CDF **	pg	3.9 (2)	3.9	30	6.0	0.100	0.390		4767357
1,2,3,7,8-Penta CDF **	pg	<2.7	2.7	30	6.0	0.0300	0.0810		4767357
2,3,4,7,8-Penta CDF **	pg	<2.7	2.7	30	6.0	0.300	0.810		4767357
1,2,3,4,7,8-Hexa CDF **	pg	<3.3	3.3	30	6.0	0.100	0.330		4767357
1,2,3,6,7,8-Hexa CDF **	pg	<3.2	3.2	30	6.0	0.100	0.320		4767357
2,3,4,6,7,8-Hexa CDF **	pg	<3.5	3.5	30	6.0	0.100	0.350		4767357
1,2,3,7,8,9-Hexa CDF **	pg	<3.6	3.6	30	6.0	0.100	0.360		4767357
1,2,3,4,6,7,8-Hepta CDF **	pg	3.1	2.6	30	9.0	0.0100	0.0310		4767357
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.1	3.1	30	6.0	0.0100	0.0310		4767357
Total Tetra CDF **	pg	3.9	3.9	30	N/A			1	4767357
Total Penta CDF **	pg	<2.7	2.7	30	N/A			0	4767357
Total Hexa CDF **	pg	<3.4	3.4	30	N/A			0	4767357
Total Hepta CDF **	pg	3.1	2.8	30	N/A			1	4767357
TOTAL TOXIC EQUIVALENCY	pg						10.0		

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

N/A = Not Applicable

** CDF = Chloro Dibenzo-p-Furan

(1) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

(2) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical

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Maxxam Job #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC907							
Sampling Date		2016/10/28							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- PEC-R3**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Surrogate Recovery (%)									
C13-1234678 HeptaCDD *	%	62							4767357
C13-1234678 HeptaCDF **	%	60							4767357
C13-123478 HexaCDD *	%	103							4767357
C13-123478 HexaCDF **	%	99							4767357
C13-1234789 HeptaCDF **	%	96							4767357
C13-123678 HexaCDD *	%	84							4767357
C13-123678 HexaCDF **	%	66							4767357
C13-12378 PentaCDD *	%	74							4767357
C13-12378 PentaCDF **	%	77							4767357
C13-123789 HexaCDF **	%	65							4767357
C13-23478 PentaCDF **	%	104							4767357
C13-2378 TetraCDD *	%	95							4767357
C13-2378 TetraCDF **	%	80							4767357
C13-Octachlorodibenzo-p-Dioxin	%	61							4767357
Cl37-2378 TetraCDD *	%	93							4767357

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 #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC954							
Sampling Date		2016/10/26							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- QUENCH-R1**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Dioxins & Furans									
2,3,7,8-Tetra CDD *	pg	<3.2	3.2	30	6.0	1.00	3.20		4767357
1,2,3,7,8-Penta CDD *	pg	<5.6	5.6	30	6.0	1.00	5.60		4767357
1,2,3,4,7,8-Hexa CDD *	pg	<3.6	3.6	30	6.0	0.100	0.360		4767357
1,2,3,6,7,8-Hexa CDD *	pg	11.0	3.7	30	6.0	0.100	1.10		4767357
1,2,3,7,8,9-Hexa CDD *	pg	13.2 (1)	3.4	30	6.0	0.100	1.32		4767357
1,2,3,4,6,7,8-Hepta CDD *	pg	289	3.5	30	9.0	0.0100	2.89		4767357
Total Tetra CDD *	pg	<6.8 (2)	6.8	30	N/A			0	4767357
Total Penta CDD *	pg	<18 (3)	18	30	N/A			0	4767357
Total Hexa CDD *	pg	282	3.5	30	N/A			6	4767357
Total Hepta CDD *	pg	1590	3.5	30	N/A			2	4767357
2,3,7,8-Tetra CDF **	pg	31.2	3.7	30	6.0	0.100	3.12		4767357
1,2,3,7,8-Penta CDF **	pg	<4.4	4.4	30	6.0	0.0300	0.132		4767357
2,3,4,7,8-Penta CDF **	pg	<4.4	4.4	30	6.0	0.300	1.32		4767357
1,2,3,4,7,8-Hexa CDF **	pg	7.6	3.0	30	6.0	0.100	0.760		4767357
1,2,3,6,7,8-Hexa CDF **	pg	<2.9	2.9	30	6.0	0.100	0.290		4767357
2,3,4,6,7,8-Hexa CDF **	pg	3.9	3.1	30	6.0	0.100	0.390		4767357
1,2,3,7,8,9-Hexa CDF **	pg	<3.3	3.3	30	6.0	0.100	0.330		4767357
1,2,3,4,6,7,8-Hepta CDF **	pg	19.7	3.3	30	9.0	0.0100	0.197		4767357
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.9	3.9	30	6.0	0.0100	0.0390		4767357
Total Tetra CDF **	pg	51.0	3.7	30	N/A			3	4767357
Total Penta CDF **	pg	9.8	4.4	30	N/A			1	4767357
Total Hexa CDF **	pg	25.5	3.1	30	N/A			4	4767357
Total Hepta CDF **	pg	66.3	3.5	30	N/A			2	4767357
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	28.8	3.8	30	N/A	0.100	2.88		4775791

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
(2) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.
(3) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.
RT>2 seconds - PCDD/DF analysis-Peak maxima of monitored ions exceeds 2 seconds

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Maxxam Job #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC954							
Sampling Date		2016/10/26							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- QUENCH-R1**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
TOTAL TOXIC EQUIVALENCY	pg						20.8		
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	76							4775791
C13-1234678 HeptaCDD *	%	61							4767357
C13-1234678 HeptaCDF **	%	56							4767357
C13-123478 HexaCDD *	%	96							4767357
C13-123478 HexaCDF **	%	85							4767357
C13-1234789 HeptaCDF **	%	98							4767357
C13-123678 HexaCDD *	%	78							4767357
C13-123678 HexaCDF **	%	68							4767357
C13-12378 PentaCDD *	%	65							4767357
C13-12378 PentaCDF **	%	67							4767357
C13-123789 HexaCDF **	%	69							4767357
C13-23478 PentaCDF **	%	107							4767357
C13-2378 TetraCDD *	%	89							4767357
C13-2378 TetraCDF **	%	76							4767357
C13-Octachlorodibenzo-p-Dioxin	%	60							4767357
Cl37-2378 TetraCDD *	%	95							4767357

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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Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC955							
Sampling Date		2016/10/26							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- QUENCH-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		4767357
1,2,3,7,8-Penta CDD *	pg	<4.3	4.3	30	6.0	1.00	4.30		4767357
1,2,3,4,7,8-Hexa CDD *	pg	<3.2	3.2	30	6.0	0.100	0.320		4767357
1,2,3,6,7,8-Hexa CDD *	pg	11.6	3.3	30	6.0	0.100	1.16		4767357
1,2,3,7,8,9-Hexa CDD *	pg	16.5	3.0	30	6.0	0.100	1.65		4767357
1,2,3,4,6,7,8-Hepta CDD *	pg	215	3.0	30	9.0	0.0100	2.15		4767357
Total Tetra CDD *	pg	<3.4	3.4	30	N/A			0	4767357
Total Penta CDD *	pg	6.4	4.3	30	N/A			1	4767357
Total Hexa CDD *	pg	284	3.2	30	N/A			5	4767357
Total Hepta CDD *	pg	850	3.0	30	N/A			2	4767357
2,3,7,8-Tetra CDF **	pg	27.4	4.9	30	6.0	0.100	2.74		4767357
1,2,3,7,8-Penta CDF **	pg	<4.4	4.4	30	6.0	0.0300	0.132		4767357
2,3,4,7,8-Penta CDF **	pg	<4.4	4.4	30	6.0	0.300	1.32		4767357
1,2,3,4,7,8-Hexa CDF **	pg	<4.1	4.1	30	6.0	0.100	0.410		4767357
1,2,3,6,7,8-Hexa CDF **	pg	<3.9	3.9	30	6.0	0.100	0.390		4767357
2,3,4,6,7,8-Hexa CDF **	pg	<4.3	4.3	30	6.0	0.100	0.430		4767357
1,2,3,7,8,9-Hexa CDF **	pg	<4.5	4.5	30	6.0	0.100	0.450		4767357
1,2,3,4,6,7,8-Hepta CDF **	pg	8.6	3.0	30	9.0	0.0100	0.0860		4767357
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.5	3.5	30	6.0	0.0100	0.0350		4767357
Total Tetra CDF **	pg	27.4	4.9	30	N/A			1	4767357
Total Penta CDF **	pg	<4.4	4.4	30	N/A			0	4767357
Total Hexa CDF **	pg	<4.2	4.2	30	N/A			0	4767357
Total Hepta CDF **	pg	8.6	3.2	30	N/A			1	4767357
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	7.2 (1)	1.6	30	N/A	0.100	0.720		4775791
TOTAL TOXIC EQUIVALENCY	pg						17.0		

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 #: B6O1812
Report Date: 2016/12/02

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC955							
Sampling Date		2016/10/26							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- QUENCH-R3**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	57							4775791
C13-1234678 HeptaCDD *	%	63							4767357
C13-1234678 HeptaCDF **	%	60							4767357
C13-123478 HexaCDD *	%	98							4767357
C13-123478 HexaCDF **	%	95							4767357
C13-1234789 HeptaCDF **	%	96							4767357
C13-123678 HexaCDD *	%	84							4767357
C13-123678 HexaCDF **	%	68							4767357
C13-12378 PentaCDD *	%	72							4767357
C13-12378 PentaCDF **	%	77							4767357
C13-123789 HexaCDF **	%	65							4767357
C13-23478 PentaCDF **	%	102							4767357
C13-2378 TetraCDD *	%	91							4767357
C13-2378 TetraCDF **	%	56							4767357
C13-Octachlorodibenzo-p-Dioxin	%	64							4767357
Cl37-2378 TetraCDD *	%	101							4767357

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

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC956							
Sampling Date		2016/10/26							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- QUENCH-R4**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Dioxins & Furans									
2,3,7,8-Tetra CDD *	pg	<4.6	4.6	30	6.0	1.00	4.60		4767357
1,2,3,7,8-Penta CDD *	pg	<4.2	4.2	30	6.0	1.00	4.20		4767357
1,2,3,4,7,8-Hexa CDD *	pg	<3.9	3.9	30	6.0	0.100	0.390		4767357
1,2,3,6,7,8-Hexa CDD *	pg	<3.9	3.9	30	6.0	0.100	0.390		4767357
1,2,3,7,8,9-Hexa CDD *	pg	5.5	3.6	30	6.0	0.100	0.550		4767357
1,2,3,4,6,7,8-Hepta CDD *	pg	48.3	2.9	30	9.0	0.0100	0.483		4767357
Total Tetra CDD *	pg	12.0	4.6	30	N/A			2	4767357
Total Penta CDD *	pg	11.8	4.2	30	N/A			1	4767357
Total Hexa CDD *	pg	76.5	3.8	30	N/A			3	4767357
Total Hepta CDD *	pg	186	2.9	30	N/A			2	4767357
2,3,7,8-Tetra CDF **	pg	47.7	4.2	30	6.0	0.100	4.77		4767357
1,2,3,7,8-Penta CDF **	pg	<4.4	4.4	30	6.0	0.0300	0.132		4767357
2,3,4,7,8-Penta CDF **	pg	<4.4	4.4	30	6.0	0.300	1.32		4767357
1,2,3,4,7,8-Hexa CDF **	pg	<3.8	3.8	30	6.0	0.100	0.380		4767357
1,2,3,6,7,8-Hexa CDF **	pg	<3.7	3.7	30	6.0	0.100	0.370		4767357
2,3,4,6,7,8-Hexa CDF **	pg	<4.0	4.0	30	6.0	0.100	0.400		4767357
1,2,3,7,8,9-Hexa CDF **	pg	<4.2	4.2	30	6.0	0.100	0.420		4767357
1,2,3,4,6,7,8-Hepta CDF **	pg	3.9	2.6	30	9.0	0.0100	0.0390		4767357
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.1	3.1	30	6.0	0.0100	0.0310		4767357
Total Tetra CDF **	pg	74.5	4.2	30	N/A			3	4767357
Total Penta CDF **	pg	<4.7 (1)	4.7	30	N/A			0	4767357
Total Hexa CDF **	pg	<3.9	3.9	30	N/A			0	4767357
Total Hepta CDF **	pg	9.3	2.8	30	N/A			2	4767357
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	30.5	3.6	30	N/A	0.100	3.05		4775791
TOTAL TOXIC EQUIVALENCY	pg						16.8		

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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Maxxam Job #: B6O1812
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Montrose Air Quality Services, LLC
Client Project #: 106377/ (16-167)

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DKC956							
Sampling Date		2016/10/26							
COC Number		23262				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23- QUENCH-R4**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	108							4775791
C13-1234678 HeptaCDD *	%	80							4767357
C13-1234678 HeptaCDF **	%	74							4767357
C13-123478 HexaCDD *	%	101							4767357
C13-123478 HexaCDF **	%	98							4767357
C13-1234789 HeptaCDF **	%	95							4767357
C13-123678 HexaCDD *	%	101							4767357
C13-123678 HexaCDF **	%	81							4767357
C13-12378 PentaCDD *	%	89							4767357
C13-12378 PentaCDF **	%	95							4767357
C13-123789 HexaCDF **	%	65							4767357
C13-23478 PentaCDF **	%	98							4767357
C13-2378 TetraCDD *	%	113							4767357
C13-2378 TetraCDF **	%	100							4767357
C13-Octachlorodibenzo-p-Dioxin	%	73							4767357
Cl37-2378 TetraCDD *	%	102							4767357

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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Report Date: 2016/12/02

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

SEMI-VOLATILE ORGANICS BY GC-MS (STACK SAMPLING TRAIN)

Maxxam ID		DKC905			DKC906	DKC907			DKC954			
Sampling Date		2016/10/28			2016/10/28	2016/10/28			2016/10/26			
COC Number		23262			23262	23262			23262			
	UNITS	**M23- PEC-R1**	**RDL**	**MDL**	**M23- PEC-R2**	**M23- PEC-R3**	**RDL**	**MDL**	**M23- QUENCH-R1**	**RDL**	**MDL**	**QC Batch**
Semivolatile Organics												
Acenaphthene	ug	<20	20	3	<20	<20	20	3	30	20	3	4740326
Acenaphthylene	ug	<20	20	4	<20	<20	20	4	69	20	4	4740326
Anthracene	ug	<20	20	5	<20	<20	20	5	33	20	5	4740326
Benzo(a)anthracene	ug	<20	20	5	<20	<20	20	5	<20	20	5	4740326
Benzo(a)pyrene	ug	<20	20	4	<20	<20	20	4	<20	20	4	4740326
Benzo(b)fluoranthene	ug	<20	20	5	<20	<20	20	5	<20	20	5	4740326
Benzo(g,h,i)perylene	ug	<20	20	5	<20	<20	20	5	<20	20	5	4740326
Benzo(k)fluoranthene	ug	<20	20	4	<20	<20	20	4	<20	20	4	4740326
Chrysene	ug	<20	20	5	<20	<20	20	5	<20	20	5	4740326
Dibenz(a,h)anthracene	ug	<20	20	5	<20	<20	20	5	<20	20	5	4740326
Fluoranthene	ug	<20	20	5	<20	<20	20	5	52	20	5	4740326
Fluorene	ug	<20	20	5	<20	<20	20	5	58	20	5	4740326
Indeno(1,2,3-cd)pyrene	ug	<20	20	3	<20	<20	20	3	<20	20	3	4740326
Naphthalene	ug	128	20	3	184	301	80	10	228	80	10	4740326
Phenanthrene	ug	<20	20	5	<20	<20	20	5	156	80	20	4740326
Pyrene	ug	<20	20	4	<20	<20	20	4	46	20	4	4740326
Surrogate Recovery (%)												
2,4,6-Tribromophenol	%	112			82	97			68			4740326
2,6-Dibromo-4-fluorophenol (FS)	%	51			48	49			44			4740326
2-Fluorobiphenyl	%	90			103	89			77			4740326
2-Fluorophenol	%	87			78	79			63			4740326
D10-Pyrene (FS)	%	107			114	108			102			4740326
D14-Terphenyl	%	110			112	106			92			4740326
D5-Nitrobenzene	%	85			99	85			73			4740326
D5-Phenol	%	88			96	89			70			4740326

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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SEMI-VOLATILE ORGANICS BY GC-MS (STACK SAMPLING TRAIN)

Maxxam ID		DKC955	DKC956			
Sampling Date		2016/10/26	2016/10/26			
COC Number		23262	23262			
	UNITS	**M23- QUENCH-R3**	**M23- QUENCH-R4**	**RDL**	**MDL**	**QC Batch**
Semivolatile Organics						
Acenaphthene	ug	36	24	20	3	4740326
Acenaphthylene	ug	37	<20	20	4	4740326
Anthracene	ug	27	<20	20	5	4740326
Benzo(a)anthracene	ug	<20	<20	20	5	4740326
Benzo(a)pyrene	ug	<20	<20	20	4	4740326
Benzo(b)fluoranthene	ug	<20	<20	20	5	4740326
Benzo(g,h,i)perylene	ug	<20	<20	20	5	4740326
Benzo(k)fluoranthene	ug	<20	<20	20	4	4740326
Chrysene	ug	<20	<20	20	5	4740326
Dibenz(a,h)anthracene	ug	<20	<20	20	5	4740326
Fluoranthene	ug	59	29	20	5	4740326
Fluorene	ug	44	30	20	5	4740326
Indeno(1,2,3-cd)pyrene	ug	<20	<20	20	3	4740326
Naphthalene	ug	137	126	20	3	4740326
Phenanthrene	ug	148	77	20	5	4740326
Pyrene	ug	41	25	20	4	4740326
Surrogate Recovery (%)						
2,4,6-Tribromophenol	%	65	76			4740326
2,6-Dibromo-4-fluorophenol (FS)	%	41	50			4740326
2-Fluorobiphenyl	%	76	103			4740326
2-Fluorophenol	%	62	75			4740326
D10-Pyrene (FS)	%	101	121			4740326
D14-Terphenyl	%	97	117			4740326
D5-Nitrobenzene	%	77	96			4740326
D5-Phenol	%	72	86			4740326

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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TEST SUMMARY

Maxxam ID: DKC905
Sample ID: M23- PEC- R1
Matrix: Stack Sampling Train

Collected: 2016/10/28
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4740326	2016/11/09	2016/11/24	Lidija Tomic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4767357	2016/11/09	2016/11/30	Owen Cosby

Maxxam ID: DKC906
Sample ID: M23- PEC- R2
Matrix: Stack Sampling Train

Collected: 2016/10/28
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4740326	2016/11/09	2016/11/24	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4775791	N/A	2016/12/01	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4767357	2016/11/09	2016/11/30	Owen Cosby

Maxxam ID: DKC907
Sample ID: M23- PEC- R3
Matrix: Stack Sampling Train

Collected: 2016/10/28
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4740326	2016/11/09	2016/11/24	Lidija Tomic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4767357	2016/11/09	2016/11/30	Owen Cosby

Maxxam ID: DKC954
Sample ID: M23- QUENCH- R1
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4740326	2016/11/09	2016/11/24	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4775791	N/A	2016/12/01	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4767357	2016/11/09	2016/11/30	Owen Cosby

Maxxam ID: DKC955
Sample ID: M23- QUENCH- R3
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4740326	2016/11/09	2016/11/24	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4775791	N/A	2016/12/01	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4767357	2016/11/09	2016/11/30	Owen Cosby

Maxxam ID: DKC956
Sample ID: M23- QUENCH- R4
Matrix: Stack Sampling Train

Collected: 2016/10/26
Shipped:
Received: 2016/11/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4740326	2016/11/09	2016/11/25	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4775791	N/A	2016/12/01	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4767357	2016/11/09	2016/11/30	Owen Cosby

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GENERAL COMMENTS

ABNs:
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 =99.425 %
Spike Dup = 104.59%

Perylene was not present in any of the samples - estimated DL=15ug

Sample DKC906 [M23- PEC- R2] : A 5 X dilution was run for Naphthalene. Mdl raised accordingly.

Sample DKC907 [M23- PEC- R3] : A 5 X dilution was run for Naphthalene. Mdl raised accordingly.

Sample DKC954 [M23- QUENCH- R1] : A 5 X dilution was run for Naphthalene and Phenanthrene. Mdl raised accordingly.

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
4740326	LTO	Spiked Blank	2,4,6-Tribromophenol	2016/11/24		104	%	24 - 121
			2-Fluorobiphenyl	2016/11/24		96	%	30 - 115
			2-Fluorophenol	2016/11/24		80	%	30 - 130
			Acenaphthene	2016/11/24		102	%	40 - 125
			Acenaphthylene	2016/11/24		101	%	40 - 125
			Anthracene	2016/11/24		100	%	40 - 125
			Benzo(a)anthracene	2016/11/24		109	%	40 - 125
			Benzo(a)pyrene	2016/11/24		99	%	40 - 125
			Benzo(b)fluoranthene	2016/11/24		104	%	40 - 125
			Benzo(g,h,i)perylene	2016/11/24		101	%	40 - 125
			Benzo(k)fluoranthene	2016/11/24		107	%	40 - 125
			Chrysene	2016/11/24		116	%	40 - 125
			D14-Terphenyl	2016/11/24		110	%	18 - 137
			D5-Nitrobenzene	2016/11/24		89	%	23 - 120
			D5-Phenol	2016/11/24		94	%	24 - 113
			Dibenz(a,h)anthracene	2016/11/24		99	%	40 - 125
			Fluoranthene	2016/11/24		109	%	40 - 125
			Fluorene	2016/11/24		103	%	40 - 125
			Indeno(1,2,3-cd)pyrene	2016/11/24		109	%	40 - 125
			Naphthalene	2016/11/24		93	%	40 - 125
			Phenanthrene	2016/11/24		107	%	40 - 125
			Pyrene	2016/11/24		108	%	40 - 125
4740326	LTO	RPD	Acenaphthene	2016/11/24	1.2		%	50
			Acenaphthylene	2016/11/24	7.2		%	50
			Anthracene	2016/11/24	4.7		%	50
			Benzo(a)anthracene	2016/11/24	4.6		%	50
			Benzo(a)pyrene	2016/11/24	0.77		%	50
			Benzo(b)fluoranthene	2016/11/24	0.59		%	50
			Benzo(g,h,i)perylene	2016/11/24	0.14		%	50
			Benzo(k)fluoranthene	2016/11/24	2.5		%	50
			Chrysene	2016/11/24	1.5		%	50
			Dibenz(a,h)anthracene	2016/11/24	2.2		%	50
			Fluoranthene	2016/11/24	4.8		%	50
			Fluorene	2016/11/24	5.2		%	50
			Indeno(1,2,3-cd)pyrene	2016/11/24	11		%	50
			Naphthalene	2016/11/24	0.66		%	50
			Phenanthrene	2016/11/24	1.2		%	50
			Pyrene	2016/11/24	1.1		%	50
4740326	LTO	Method Blank	2,4,6-Tribromophenol	2016/11/24		103	%	24 - 121
			2-Fluorobiphenyl	2016/11/24		104	%	30 - 115
			2-Fluorophenol	2016/11/24		88	%	30 - 130
			Acenaphthene	2016/11/24	<20		ug	
			Acenaphthylene	2016/11/24	<20		ug	
			Anthracene	2016/11/24	<20		ug	
			Benzo(a)anthracene	2016/11/24	<20		ug	
			Benzo(a)pyrene	2016/11/24	<20		ug	
			Benzo(b)fluoranthene	2016/11/24	<20		ug	
			Benzo(g,h,i)perylene	2016/11/24	<20		ug	
			Benzo(k)fluoranthene	2016/11/24	<20		ug	
			Chrysene	2016/11/24	<20		ug	
			D14-Terphenyl	2016/11/24		106	%	18 - 137
			D5-Nitrobenzene	2016/11/24		104	%	23 - 120
			D5-Phenol	2016/11/24		102	%	24 - 113
			Dibenz(a,h)anthracene	2016/11/24	<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
			Fluoranthene	2016/11/24	<20		ug	
			Fluorene	2016/11/24	<20		ug	
			Indeno(1,2,3-cd)pyrene	2016/11/24	<20		ug	
			Naphthalene	2016/11/24	<20		ug	
			Phenanthrene	2016/11/24	<20		ug	
			Pyrene	2016/11/24	<20		ug	
4767357	OBC	Spiked Blank	C13-1234678 HeptaCDD	2016/11/29		64	%	25 - 130
			C13-1234678 HeptaCDF	2016/11/29		61	%	25 - 130
			C13-123678 HexaCDD	2016/11/29		72	%	40 - 130
			C13-123678 HexaCDF	2016/11/29		60	%	40 - 130
			C13-12378 PentaCDD	2016/11/29		78	%	40 - 130
			C13-12378 PentaCDF	2016/11/29		80	%	40 - 130
			C13-123789 HexaCDF	2016/11/29		58	%	40 - 130
			C13-2378 TetraCDD	2016/11/29		93	%	40 - 130
			C13-2378 TetraCDF	2016/11/29		80	%	40 - 130
			C13-Octachlorodibenzo-p-Dioxin	2016/11/29		71	%	25 - 130
			2,3,7,8-Tetra CDD	2016/11/29		90	%	80 - 140
			1,2,3,7,8-Penta CDD	2016/11/29		86	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2016/11/29		135	%	80 - 140
			1,2,3,6,7,8-Hexa CDD	2016/11/29		108	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2016/11/29		114	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDD	2016/11/29		102	%	80 - 140
			2,3,7,8-Tetra CDF	2016/11/29		96	%	80 - 140
			1,2,3,7,8-Penta CDF	2016/11/29		89	%	80 - 140
			2,3,4,7,8-Penta CDF	2016/11/29		93	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2016/11/29		125	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2016/11/29		100	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2016/11/29		103	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2016/11/29		125	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2016/11/29		97	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2016/11/29		100	%	80 - 140
4767357	OBC	RPD	2,3,7,8-Tetra CDD	2016/11/29	3.3		%	20
			1,2,3,7,8-Penta CDD	2016/11/29	3.4		%	20
			1,2,3,4,7,8-Hexa CDD	2016/11/29	4.5		%	20
			1,2,3,6,7,8-Hexa CDD	2016/11/29	3.8		%	20
			1,2,3,7,8,9-Hexa CDD	2016/11/29	1.7		%	20
			1,2,3,4,6,7,8-Hepta CDD	2016/11/29	1.9		%	20
			2,3,7,8-Tetra CDF	2016/11/29	1.0		%	20
			1,2,3,7,8-Penta CDF	2016/11/29	1.1		%	20
			2,3,4,7,8-Penta CDF	2016/11/29	5.2		%	20
			1,2,3,4,7,8-Hexa CDF	2016/11/29	2.4		%	20
			1,2,3,6,7,8-Hexa CDF	2016/11/29	3.0		%	20
			2,3,4,6,7,8-Hexa CDF	2016/11/29	1.9		%	20
			1,2,3,7,8,9-Hexa CDF	2016/11/29	3.3		%	20
			1,2,3,4,6,7,8-Hepta CDF	2016/11/29	1.0		%	20
			1,2,3,4,7,8,9-Hepta CDF	2016/11/29	5.1		%	20
4767357	OBC	Method Blank	C13-1234678 HeptaCDD	2016/11/30		89	%	25 - 130
			C13-1234678 HeptaCDF	2016/11/30		75	%	25 - 130
			C13-123678 HexaCDD	2016/11/30		90	%	40 - 130
			C13-123678 HexaCDF	2016/11/30		77	%	40 - 130
			C13-12378 PentaCDD	2016/11/30		85	%	40 - 130
			C13-12378 PentaCDF	2016/11/30		92	%	40 - 130
			C13-123789 HexaCDF	2016/11/30		67	%	40 - 130
			C13-2378 TetraCDD	2016/11/30		109	%	40 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			C13-2378 TetraCDF	2016/11/30		95	%	40 - 130
			C13-Octachlorodibenzo-p-Dioxin	2016/11/30		75	%	25 - 130
			2,3,7,8-Tetra CDD	2016/11/30	<3.1, EDL=3.1		pg	
			1,2,3,7,8-Penta CDD	2016/11/30	<3.4, EDL=3.4		pg	
			1,2,3,4,7,8-Hexa CDD	2016/11/30	<3.6, EDL=3.6		pg	
			1,2,3,6,7,8-Hexa CDD	2016/11/30	<3.6, EDL=3.6		pg	
			1,2,3,7,8,9-Hexa CDD	2016/11/30	<3.3, EDL=3.3		pg	
			1,2,3,4,6,7,8-Hepta CDD	2016/11/30	<3.1, EDL=3.1		pg	
			Total Tetra CDD	2016/11/30	<3.7, EDL=3.7 (1)		pg	
			Total Penta CDD	2016/11/30	<3.4, EDL=3.4		pg	
			Total Hexa CDD	2016/11/30	<6.8, EDL=6.8 (1)		pg	
			Total Hepta CDD	2016/11/30	<3.1, EDL=3.1		pg	
			2,3,7,8-Tetra CDF	2016/11/30	<2.7, EDL=2.7		pg	
			1,2,3,7,8-Penta CDF	2016/11/30	<3.7, EDL=3.7		pg	
			2,3,4,7,8-Penta CDF	2016/11/30	<3.7, EDL=3.7		pg	
			1,2,3,4,7,8-Hexa CDF	2016/11/30	<3.3, EDL=3.3		pg	
			1,2,3,6,7,8-Hexa CDF	2016/11/30	<3.1, EDL=3.1		pg	
			2,3,4,6,7,8-Hexa CDF	2016/11/30	<3.4, EDL=3.4		pg	
			1,2,3,7,8,9-Hexa CDF	2016/11/30	<3.6, EDL=3.6		pg	
			1,2,3,4,6,7,8-Hepta CDF	2016/11/30	<2.7, EDL=2.7		pg	
			1,2,3,4,7,8,9-Hepta CDF	2016/11/30	<3.1, EDL=3.1		pg	
			Total Tetra CDF	2016/11/30	<2.7, EDL=2.7		pg	
			Total Penta CDF	2016/11/30	<3.7, EDL=3.7		pg	
			Total Hexa CDF	2016/11/30	<3.4, EDL=3.4		pg	
			Total Hepta CDF	2016/11/30	<2.9, EDL=2.9		pg	
4775791	VCI	Method Blank	Confirmation 2,3,7,8-Tetra CDF	2016/12/01	<2.4, EDL=2.4		pg	

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Maxxam Job #: B6O1812
Report Date: 2016/12/02

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	2016/12/01		97	%	40 - 135

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

(1) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

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Maxxam
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Maxxam Job #: B6O1812
Report Date: 2016/12/02

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

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Karen Nicol

Karen Nicol, Supervisor, Semi-Volatiles

Owen Cosby, BSc.C.Chem, Supervisor, HRMS Services

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Method 316

Maxxam
A Bureau Veritas Group Company

Your Project #: 106377 (16-167)
Site Location: ARCELLOR MITTAL
Your C.O.C. #: 22602

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/04
Report #: R4235386
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N4185
Received: 2016/10/28, 15:00

Sample Matrix: Stack Sampling Train
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Formaldehyde (M316)	4	2016/11/03	2016/11/03	BRL SOP-00113	EPA 316 m
Final Volume of Impinger	4	N/A	2016/11/03		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods. Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
04 Nov 2016 16:34:49 -04:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905)817-5769

==========

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Maxxam Job #: B6N4185
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377 (16-167)
Site Location: ARCELLOR MITTAL

RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

Maxxam ID		DIQ475	DIQ480			DIQ481			DIQ482			
Sampling Date												
COC Number		22602	22602			22602			22602			
	UNITS	**M316- BLANK**	**M316- R1**	**RDL**	**MDL**	**M316- R2**	**RDL**	**MDL**	**M316- R3**	**RDL**	**MDL**	**QC Batch**
Aldehydes & Ketones												
Formaldehyde	ug	<12	<12	12	7.2	34	13	7.8	<11	11	6.6	4731052
Impinger Volume	ml	480	490	1	1	510	1	1	430	1	1	4731057

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N4185
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377 (16-167)
Site Location: ARCELLOR MITTAL

TEST SUMMARY

Maxxam ID: DIQ475
Sample ID: M316- BLANK
Matrix: Stack Sampling Train

Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

Maxxam ID: DIQ480
Sample ID: M316- R1
Matrix: Stack Sampling Train

Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

Maxxam ID: DIQ481
Sample ID: M316- R2
Matrix: Stack Sampling Train

Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

Maxxam ID: DIQ482
Sample ID: M316- R3
Matrix: Stack Sampling Train

Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

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Maxxam Job #: B6N4185
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377 (16-167)
Site Location: ARCELLOR MITTAL

GENERAL COMMENTS

Sample DIQ480-01 : Sample filtered due to suspended particles

Sample DIQ481-01 : Sample filtered due to suspended particles

Sample DIQ482-01 : Sample filtered due to suspended particles

Results relate only to the items tested.

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Maxxam Job #: B6N4185
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377 (16-167)
Site Location: ARCELLOR MITTAL

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
4731052	MGE	Matrix Spike	Formaldehyde	2016/11/03		67 (1)	%	80 - 120
4731052	MGE	Spiked Blank	Formaldehyde	2016/11/03		105	%	91 - 107
4731052	MGE	Method Blank	Formaldehyde	2016/11/03	<0.03		ug	
4731052	MGE	RPD - Sample/Sample Dup	Formaldehyde	2016/11/03	NC		%	20

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Matrix Spike failed due to interference.

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Maxxam Job #: B6N4185
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377 (16-167)
Site Location: ARCELLOR MITTAL

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

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Methods 0031

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Your Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/10
Report #: R4242191
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N5397
Received: 2016/10/28, 15:00

Sample Matrix: Stack Sampling Train
Samples Received: 20

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
VOST Condensate (8260Cmod)	9	N/A	2016/11/04	CAM SOP-00226	EPA 8260C m
VOST EPA5041A, 8260C for 0030, 0031	11	N/A	2016/11/02	BRL SOP-00302	EPA5041A, 8260C

Remarks:

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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.

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
10 Nov 2016 12:48:22 -05:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905)817-5769
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Total Cover Pages : 1

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Maxxam Job #: B6N5397
Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX369	DIX370	DIX372			
Sampling Date							
	UNITS	M0031- TRIB- #11 A/B/C	M0031- FB- #10 A/B/C	M0031- R1- A- #1 A/B/C	RDL	MDL	QC Batch
Volatile Organics							
Chloromethane	ug	<0.015	<0.015	0.071	0.015	0.015	4729809
Vinyl Chloride	ug	<0.013	<0.013	<0.013	0.013	0.013	4729809
Bromomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4729809
Chloroethane	ug	<0.0090	<0.0090	<0.0090	0.0090	0.0090	4729809
1,1-Dichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Iodomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4729809
Carbon Disulfide	ug	<0.026	<0.026	1.71	0.026	0.026	4729809
Methylene Chloride(Dichloromethane)	ug	<0.019	<0.019	<0.019	0.019	0.020	4729809
Chloroform	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
1,2-Dichloroethane	ug	<0.0070	<0.0070	<0.0070	0.0070	0.0070	4729809
1,1,1-Trichloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4729809
Carbon Tetrachloride	ug	<0.016	<0.016	<0.016	0.016	0.016	4729809
Benzene	ug	<0.0090	0.0104	2.27	0.0090	0.0090	4729809
1,1,2-Trichloroethane	ug	<0.016	<0.016	<0.016	0.016	0.016	4729809
1,2-Dichloropropane	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Trichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Toluene	ug	<0.014	<0.014	0.756	0.014	0.014	4729809
Tetrachloroethylene	ug	<0.018	<0.018	<0.018	0.018	0.018	4729809
Chlorobenzene	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Ethylbenzene	ug	<0.014	<0.014	0.050	0.014	0.014	4729809
m / p-Xylene	ug	<0.015	<0.015	0.430	0.015	0.015	4729809
Styrene	ug	<0.012	<0.012	0.161	0.012	0.012	4729809
o-Xylene	ug	<0.015	<0.015	0.103	0.015	0.015	4729809
Bromoform	ug	<0.014	<0.014	<0.014	0.014	0.014	4729809
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4729809
Acrylonitrile	ug	<0.025	<0.025	<0.025	0.025	0.025	4729809
Surrogate Recovery (%)							
Bromofluorobenzene	%	100	98	96			4729809
D10-Ethylbenzene (FS)	%	115	125	100			4729809
D4-1,2-Dichloroethane	%	108	108	114			4729809
D8-Toluene	%	102	102	98			4729809

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B6N5397
Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX374	DIX376	DIX377			
Sampling Date							
	UNITS	**M0031- R1- B- #2 A/B/C**	**M0031- R1- C- #3 A/B/C**	**M0031- R2- A- #4 A/B/C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics							
Chloromethane	ug	0.023	0.020	0.020	0.015	0.015	4729809
Vinyl Chloride	ug	<0.013	<0.013	<0.013	0.013	0.013	4729809
Bromomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4729809
Chloroethane	ug	<0.0090	<0.0090	<0.0090	0.0090	0.0090	4729809
1,1-Dichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Iodomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4729809
Carbon Disulfide	ug	1.35	1.28	2.23	0.026	0.026	4729809
Methylene Chloride(Dichloromethane)	ug	0.031	0.025	<0.019	0.019	0.020	4729809
Chloroform	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
1,2-Dichloroethane	ug	<0.0070	<0.0070	<0.0070	0.0070	0.0070	4729809
1,1,1-Trichloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4729809
Carbon Tetrachloride	ug	<0.016	<0.016	<0.016	0.016	0.016	4729809
Benzene	ug	1.97	1.45	0.795	0.0090	0.0090	4729809
1,1,2-Trichloroethane	ug	<0.016	<0.016	<0.016	0.016	0.016	4729809
1,2-Dichloropropane	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Trichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Toluene	ug	0.709	0.413	0.279	0.014	0.014	4729809
Tetrachloroethylene	ug	<0.018	<0.018	<0.018	0.018	0.018	4729809
Chlorobenzene	ug	<0.011	<0.011	<0.011	0.011	0.011	4729809
Ethylbenzene	ug	0.065	0.020	0.042	0.014	0.014	4729809
m / p-Xylene	ug	0.413	0.167	0.201	0.015	0.015	4729809
Styrene	ug	0.117	0.058	0.047	0.012	0.012	4729809
o-Xylene	ug	0.103	0.038	0.067	0.015	0.015	4729809
Bromoform	ug	<0.014	<0.014	<0.014	0.014	0.014	4729809
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4729809
Acrylonitrile	ug	<0.025	<0.025	<0.025	0.025	0.025	4729809
Surrogate Recovery (%)							
Bromofluorobenzene	%	99	99	96			4729809
D10-Ethylbenzene (FS)	%	108	120	105			4729809
D4-1,2-Dichloroethane	%	113	113	111			4729809
D8-Toluene	%	98	99	99			4729809

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
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Maxxam Job #: B6N5397
Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX379	DIX381	DIX383			
Sampling Date							
	UNITS	**M0031- R2- B- #5 A/B/C**	**M0031- R2- C- #6 A/B/C**	**M0031- R3- A- #7 A/B/C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics							
Chloromethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4731750
Vinyl Chloride	ug	<0.013	<0.013	<0.013	0.013	0.013	4731750
Bromomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4731750
Chloroethane	ug	<0.0090	<0.0090	<0.0090	0.0090	0.0090	4731750
1,1-Dichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4731750
Iodomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4731750
Carbon Disulfide	ug	<0.026	<0.026	<0.026	0.026	0.026	4731750
Methylene Chloride(Dichloromethane)	ug	0.047	0.050	0.042	0.019	0.020	4731750
Chloroform	ug	<0.011	<0.011	<0.011	0.011	0.011	4731750
1,2-Dichloroethane	ug	<0.0070	<0.0070	<0.0070	0.0070	0.0070	4731750
1,1,1-Trichloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4731750
Carbon Tetrachloride	ug	<0.016	<0.016	<0.016	0.016	0.016	4731750
Benzene	ug	0.0154	0.0100	0.0239	0.0090	0.0090	4731750
1,1,2-Trichloroethane	ug	<0.016	<0.016	<0.016	0.016	0.016	4731750
1,2-Dichloropropane	ug	<0.011	<0.011	<0.011	0.011	0.011	4731750
Trichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4731750
Toluene	ug	0.108	0.102	0.087	0.014	0.014	4731750
Tetrachloroethylene	ug	<0.018	<0.018	<0.018	0.018	0.018	4731750
Chlorobenzene	ug	<0.011	<0.011	<0.011	0.011	0.011	4731750
Ethylbenzene	ug	<0.014	<0.014	<0.014	0.014	0.014	4731750
m / p-Xylene	ug	<0.015	<0.015	<0.015	0.015	0.015	4731750
Styrene	ug	<0.012	<0.012	<0.012	0.012	0.012	4731750
o-Xylene	ug	<0.015	<0.015	<0.015	0.015	0.015	4731750
Bromoform	ug	<0.014	<0.014	<0.014	0.014	0.014	4731750
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4731750
Acrylonitrile	ug	<0.025	<0.025	<0.025	0.025	0.025	4731750
Surrogate Recovery (%)							
Bromofluorobenzene	%	100	99	102			4731750
D10-Ethylbenzene (FS)	%	95	115	100			4731750
D4-1,2-Dichloroethane	%	106	109	104			4731750
D8-Toluene	%	100	101	100			4731750

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N5397
Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX386	DIX388	DIX393			
Sampling Date							
	UNITS	**M0031- R3- B- #8 A/B/C**	**M0031- R3- C- #9 A/B/C**	**COND- R1- A**	**RDL**	**MDL**	**QC Batch**
Volatile Organics							
Chloromethane	ug	<0.015	<0.015		0.015	0.015	4731750
Chloromethane	ug/L			<4000	4000	4000	4733462
Vinyl Chloride	ug	<0.013	<0.013		0.013	0.013	4731750
Vinyl Chloride	ug/L			<800	800	800	4733462
Bromomethane	ug	<0.015	<0.015		0.015	0.015	4731750
Bromomethane	ug/L			<6000	6000	6000	4733462
Chloroethane	ug	<0.0090	<0.0090		0.0090	0.0090	4731750
Chloroethane	ug/L			<2000	2000	2000	4733462
1,1-Dichloroethylene	ug	<0.011	<0.011		0.011	0.011	4731750
Iodomethane	ug	<0.015	<0.015		0.015	0.015	4731750
Iodomethane	ug/L			<1200	1200	1200	4733462
Carbon Disulfide	ug	<0.026	<0.026		0.026	0.026	4731750
Carbon Disulfide	ug/L			<1000	1000	1000	4733462
Methylene Chloride(Dichloromethane)	ug	0.047	0.062		0.019	0.020	4731750
Methylene Chloride(Dichloromethane)	ug/L			<2000	2000	2000	4733462
1,1-Dichloroethane	ug/L			<800	800	800	4733462
Chloroform	ug	<0.011	<0.011		0.011	0.011	4731750
Chloroform	ug/L			<800	800	800	4733462
1,2-Dichloroethane	ug	<0.0070	<0.0070		0.0070	0.0070	4731750
1,2-Dichloroethane	ug/L			<1000	1000	1000	4733462
1,1,1-Trichloroethane	ug	<0.014	<0.014		0.014	0.014	4731750
1,1,1-Trichloroethane	ug/L			<1000	1000	1000	4733462
Carbon Tetrachloride	ug	<0.016	<0.016		0.016	0.016	4731750
Carbon Tetrachloride	ug/L			<1000	1000	1000	4733462
Benzene	ug	<0.0090	<0.0090		0.0090	0.0090	4731750
Benzene	ug/L			<1000	1000	1000	4733462
1,1,2-Trichloroethane	ug	<0.016	<0.016		0.016	0.016	4731750
1,2-Dichloropropane	ug	<0.011	<0.011		0.011	0.011	4731750
1,2-Dichloropropane	ug/L			<1000	1000	1000	4733462
Trichloroethylene	ug	<0.011	<0.011		0.011	0.011	4731750
Trichloroethylene	ug/L			<1000	1000	1000	4733462
Toluene	ug	0.091	0.116		0.014	0.014	4731750
Toluene	ug/L			16000	1000	1000	4733462
Tetrachloroethylene	ug	<0.018	<0.018		0.018	0.018	4731750
Tetrachloroethylene	ug/L			<1000	1000	1000	4733462

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Maxxam Job #: B6N5397
Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX386	DIX388	DIX393			
Sampling Date							
	UNITS	**M0031- R3- B- #8 A/B/C**	**M0031- R3- C- #9 A/B/C**	**COND- R1- A**	**RDL**	**MDL**	**QC Batch**
Chlorobenzene	ug	<0.011	<0.011		0.011	0.011	4731750
Chlorobenzene	ug/L			<1000	1000	1000	4733462
Ethylbenzene	ug	<0.014	<0.014		0.014	0.014	4731750
Ethylbenzene	ug/L			<1000	1000	1000	4733462
m / p-Xylene	ug	<0.015	<0.015		0.015	0.015	4731750
p+m-Xylene	ug/L			<1000	1000	1000	4733462
Styrene	ug	<0.012	<0.012		0.012	0.012	4731750
Styrene	ug/L			<1000	1000	1000	4733462
o-Xylene	ug	<0.015	<0.015		0.015	0.015	4731750
o-Xylene	ug/L			<1000	1000	1000	4733462
Bromoform	ug	<0.014	<0.014		0.014	0.014	4731750
Bromoform	ug/L			<800	800	800	4733462
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014		0.014	0.014	4731750
1,1,2,2-Tetrachloroethane	ug/L			<2000	2000	2000	4733462
Acrylonitrile	ug	<0.025	<0.025		0.025	0.025	4731750
Total Xylenes	ug/L			<1000	1000	1000	4733462
Surrogate Recovery (%)							
4-Bromofluorobenzene	%			80			4733462
D4-1,2-Dichloroethane	%			112			4733462
D8-Toluene	%			106			4733462
Bromofluorobenzene	%	100	99				4731750
D10-Ethylbenzene (FS)	%	111	96				4731750
D4-1,2-Dichloroethane	%	107	109				4731750
D8-Toluene	%	101	100				4731750

RDL = Reportable Detection Limit
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Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX395	DIX396			DIX398			
Sampling Date									
	UNITS	**COND- R1-B**	**COND- R1-C**	**RDL**	**MDL**	**COND- R2-A**	**RDL**	**MDL**	**QC Batch**
Volatile Organics									
Chloromethane	ug/L	<4000	<4000	4000	4000	<1000	1000	1000	4733462
Vinyl Chloride	ug/L	<800	<800	800	800	<200	200	200	4733462
Bromomethane	ug/L	<6000	<6000	6000	6000	<1500	1500	1500	4733462
Chloroethane	ug/L	<2000	<2000	2000	2000	<500	500	500	4733462
Iodomethane	ug/L	<1200	<1200	1200	1200	<300	300	300	4733462
Carbon Disulfide	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Methylene Chloride(Dichloromethane)	ug/L	<2000	<2000	2000	2000	<500	500	500	4733462
1,1-Dichloroethane	ug/L	<800	<800	800	800	<200	200	200	4733462
Chloroform	ug/L	<800	<800	800	800	<200	200	200	4733462
1,2-Dichloroethane	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
1,1,1-Trichloroethane	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Carbon Tetrachloride	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Benzene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
1,2-Dichloropropane	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Trichloroethylene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Toluene	ug/L	16000	17000	1000	1000	6900	250	250	4733462
Tetrachloroethylene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Chlorobenzene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Ethylbenzene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
p+m-Xylene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Styrene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
o-Xylene	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Bromoform	ug/L	<800	<800	800	800	<200	200	200	4733462
1,1,2,2-Tetrachloroethane	ug/L	<2000	<2000	2000	2000	<500	500	500	4733462
Total Xylenes	ug/L	<1000	<1000	1000	1000	<250	250	250	4733462
Surrogate Recovery (%)									
4-Bromofluorobenzene	%	85	84			81			4733462
D4-1,2-Dichloroethane	%	108	114			111			4733462
D8-Toluene	%	109	106			102			4733462

RDL = Reportable Detection Limit
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Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX399	DIX401			DIX402			
Sampling Date									
	UNITS	**COND- R2-B**	**COND- R2-C**	**RDL**	**MDL**	**COND- R3-A**	**RDL**	**MDL**	**QC Batch**
Volatile Organics									
Chloromethane	ug/L	<500	<500	500	500	<200	200	200	4733462
Vinyl Chloride	ug/L	<100	<100	100	100	<40	40	40	4733462
Bromomethane	ug/L	<750	<750	750	750	<300	300	300	4733462
Chloroethane	ug/L	<250	<250	250	250	<100	100	100	4733462
Iodomethane	ug/L	<150	<150	150	150	<60	60	60	4733462
Carbon Disulfide	ug/L	<130	<130	130	130	<50	50	50	4733462
Methylene Chloride(Dichloromethane)	ug/L	<250	<250	250	250	<100	100	100	4733462
1,1-Dichloroethane	ug/L	<100	<100	100	100	<40	40	40	4733462
Chloroform	ug/L	<100	<100	100	100	<40	40	40	4733462
1,2-Dichloroethane	ug/L	<130	<130	130	130	<50	50	50	4733462
1,1,1-Trichloroethane	ug/L	<130	<130	130	130	<50	50	50	4733462
Carbon Tetrachloride	ug/L	<130	<130	130	130	<50	50	50	4733462
Benzene	ug/L	<130	<130	130	130	<50	50	50	4733462
1,2-Dichloropropane	ug/L	<130	<130	130	130	<50	50	50	4733462
Trichloroethylene	ug/L	<130	<130	130	130	<50	50	50	4733462
Toluene	ug/L	3300	3700	130	130	900	50	50	4733462
Tetrachloroethylene	ug/L	<130	<130	130	130	<50	50	50	4733462
Chlorobenzene	ug/L	<130	<130	130	130	<50	50	50	4733462
Ethylbenzene	ug/L	<130	<130	130	130	<50	50	50	4733462
p+m-Xylene	ug/L	<130	<130	130	130	<50	50	50	4733462
Styrene	ug/L	<130	<130	130	130	<50	50	50	4733462
o-Xylene	ug/L	<130	<130	130	130	<50	50	50	4733462
Bromoform	ug/L	<100	<100	100	100	<40	40	40	4733462
1,1,2,2-Tetrachloroethane	ug/L	<250	<250	250	250	<100	100	100	4733462
Total Xylenes	ug/L	<130	<130	130	130	<50	50	50	4733462
Surrogate Recovery (%)									
4-Bromofluorobenzene	%	83	80			82			4733462
D4-1,2-Dichloroethane	%	113	112			111			4733462
D8-Toluene	%	103	103			103			4733462

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DIX403			DIX405			
Sampling Date								
	UNITS	**COND- R3-B**	**RDL**	**MDL**	**COND- R3-C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics								
Chloromethane	ug/L	<400	400	400	<500	500	500	4733462
Vinyl Chloride	ug/L	<80	80	80	<100	100	100	4733462
Bromomethane	ug/L	<600	600	600	<750	750	750	4733462
Chloroethane	ug/L	<200	200	200	<250	250	250	4733462
Iodomethane	ug/L	<120	120	120	<150	150	150	4733462
Carbon Disulfide	ug/L	<100	100	100	<130	130	130	4733462
Methylene Chloride(Dichloromethane)	ug/L	<200	200	200	<250	250	250	4733462
1,1-Dichloroethane	ug/L	<80	80	80	<100	100	100	4733462
Chloroform	ug/L	<80	80	80	<100	100	100	4733462
1,2-Dichloroethane	ug/L	<100	100	100	<130	130	130	4733462
1,1,1-Trichloroethane	ug/L	<100	100	100	<130	130	130	4733462
Carbon Tetrachloride	ug/L	<100	100	100	<130	130	130	4733462
Benzene	ug/L	<100	100	100	<130	130	130	4733462
1,2-Dichloropropane	ug/L	<100	100	100	<130	130	130	4733462
Trichloroethylene	ug/L	<100	100	100	<130	130	130	4733462
Toluene	ug/L	1900	100	100	3300	130	130	4733462
Tetrachloroethylene	ug/L	<100	100	100	<130	130	130	4733462
Chlorobenzene	ug/L	<100	100	100	<130	130	130	4733462
Ethylbenzene	ug/L	<100	100	100	<130	130	130	4733462
p+m-Xylene	ug/L	<100	100	100	<130	130	130	4733462
Styrene	ug/L	<100	100	100	<130	130	130	4733462
o-Xylene	ug/L	<100	100	100	<130	130	130	4733462
Bromoform	ug/L	<80	80	80	<100	100	100	4733462
1,1,2,2-Tetrachloroethane	ug/L	<200	200	200	<250	250	250	4733462
Total Xylenes	ug/L	<100	100	100	<130	130	130	4733462
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	80			80			4733462
D4-1,2-Dichloroethane	%	113			112			4733462
D8-Toluene	%	102			107			4733462

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N5397
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Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

TEST SUMMARY

Maxxam ID: DIX369
Sample ID: M0031- TRIB- #11 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4729809	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX370
Sample ID: M0031- FB- #10 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4729809	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX372
Sample ID: M0031- R1- A- #1 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4729809	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX374
Sample ID: M0031- R1- B- #2 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4729809	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX376
Sample ID: M0031- R1- C- #3 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4729809	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX377
Sample ID: M0031- R2- A- #4 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4729809	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX379
Sample ID: M0031- R2- B- #5 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4731750	N/A	2016/11/02	Yujie Yan

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Maxxam Job #: B6N5397
Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

TEST SUMMARY

Maxxam ID: DIX381
Sample ID: M0031- R2- C- #6 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4731750	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX383
Sample ID: M0031- R3- A- #7 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4731750	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX386
Sample ID: M0031- R3- B- #8 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4731750	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX388
Sample ID: M0031- R3- C- #9 A/B/C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4731750	N/A	2016/11/02	Yujie Yan

Maxxam ID: DIX393
Sample ID: COND- R1- A
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX395
Sample ID: COND- R1- B
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX396
Sample ID: COND- R1- C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

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Report Date: 2016/11/10

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

TEST SUMMARY

Maxxam ID: DIX398
Sample ID: COND- R2- A
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX399
Sample ID: COND- R2- B
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX401
Sample ID: COND- R2- C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX402
Sample ID: COND- R3- A
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX403
Sample ID: COND- R3- B
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

Maxxam ID: DIX405
Sample ID: COND- R3- C
Matrix: Stack Sampling Train
Collected:
Shipped:
Received: 2016/10/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4733462	N/A	2016/11/04	Yujie Yan

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Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

GENERAL COMMENTS

VOST analysis:
WS#4729809:In continuing calibration standard, Acrylonitrile exceeded the acceptance limit of 20%. The reference standard was acceptable.

Condensate analysis:
Condensate samples had 65mls.
Vinyl Chloride exceeded 130% recovery in the reference standard. There were no positives found for this compound therefore the data should not be affected.

Sample DIX372 [M0031- R1- A- #1 A/B/C] : Carbon disulfide and Benzene are over the calibration range. Data should be considered an estimate only.

Sample DIX374 [M0031- R1- B- #2 A/B/C] : Carbon disulfide and Benzene are over the calibration range. Data should be considered an estimate only.

Sample DIX376 [M0031- R1- C- #3 A/B/C] : Carbondisulfide and Benzene are over the calibration range. Data should be considered an estimate only.

Sample DIX377 [M0031- R2- A- #4 A/B/C] : Carbon disulfide is over the calibration range. Data should be considered an estimate only.

Sample DIX393 [COND- R1- A] : Sample was analyzed at a 2000x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 10000ug/L

Sample DIX395 [COND- R1- B] : Sample was analyzed at a 2000x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 10000ug/L

Sample DIX396 [COND- R1- C] : Sample was analyzed at a 2000x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 10000ug/L

Sample DIX398 [COND- R2- A] : Sample was analyzed at a 500x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 2500ug/L

Sample DIX399 [COND- R2- B] : Sample was analyzed at a 250x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 1250ug/L

Sample DIX401 [COND- R2- C] : Sample was analyzed at a 250x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 1250ug/L

Sample DIX402 [COND- R3- A] : Sample was analyzed at a 100x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 500ug/L

Sample DIX403 [COND- R3- B] : Sample was analyzed at a 200x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 1000ug/L

Sample DIX405 [COND- R3- C] : Sample was analyzed at a 250x dilution. The DLs were adjusted accordingly.
Acrylonitrile < 1250ug/L

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
4729809	YYA	Spiked Blank	Bromofluorobenzene	2016/11/02		97	%	43 - 131
			D10-Ethylbenzene (FS)	2016/11/02		102	%	47 - 157
			D4-1,2-Dichloroethane	2016/11/02		103	%	64 - 133
			D8-Toluene	2016/11/02		99	%	68 - 121
			Chloromethane	2016/11/02		97	%	50 - 150
			Vinyl Chloride	2016/11/02		95	%	50 - 150
			Bromomethane	2016/11/02		95	%	50 - 150
			Chloroethane	2016/11/02		103	%	50 - 150
			1,1-Dichloroethylene	2016/11/02		109	%	50 - 150
			Iodomethane	2016/11/02		96	%	N/A
			Carbon Disulfide	2016/11/02		100	%	50 - 150
			Methylene Chloride(Dichloromethane)	2016/11/02		106	%	50 - 150
			Chloroform	2016/11/02		108	%	50 - 150
			1,2-Dichloroethane	2016/11/02		110	%	50 - 150
			1,1,1-Trichloroethane	2016/11/02		107	%	50 - 150
			Carbon Tetrachloride	2016/11/02		108	%	50 - 150
			Benzene	2016/11/02		107	%	50 - 150
			1,1,2-Trichloroethane	2016/11/02		109	%	50 - 150
			1,2-Dichloropropane	2016/11/02		108	%	50 - 150
			Trichloroethylene	2016/11/02		110	%	50 - 150
			Toluene	2016/11/02		105	%	50 - 150
			Tetrachloroethylene	2016/11/02		109	%	50 - 150
			Chlorobenzene	2016/11/02		108	%	50 - 150
			Ethylbenzene	2016/11/02		106	%	50 - 150
			m / p-Xylene	2016/11/02		107	%	50 - 150
			Styrene	2016/11/02		107	%	50 - 150
			o-Xylene	2016/11/02		107	%	50 - 150
			Bromoform	2016/11/02		111	%	50 - 150
			1,1,2,2-Tetrachloroethane	2016/11/02		108	%	50 - 150
			Acrylonitrile	2016/11/02		93	%	N/A
4729809	YYA	Method Blank	Bromofluorobenzene	2016/11/02		99	%	43 - 131
			D10-Ethylbenzene (FS)	2016/11/02		95	%	47 - 157
			D4-1,2-Dichloroethane	2016/11/02		111	%	64 - 133
			D8-Toluene	2016/11/02		101	%	68 - 121
			Chloromethane	2016/11/02	<0.015		ug	
			Vinyl Chloride	2016/11/02	<0.013		ug	
			Bromomethane	2016/11/02	<0.015		ug	
			Chloroethane	2016/11/02	<0.0090		ug	
			1,1-Dichloroethylene	2016/11/02	<0.011		ug	
			Iodomethane	2016/11/02	<0.015		ug	
			Carbon Disulfide	2016/11/02	<0.026		ug	
			Methylene Chloride(Dichloromethane)	2016/11/02	<0.019		ug	
			Chloroform	2016/11/02	<0.011		ug	
			1,2-Dichloroethane	2016/11/02	<0.0070		ug	
			1,1,1-Trichloroethane	2016/11/02	<0.014		ug	
			Carbon Tetrachloride	2016/11/02	<0.016		ug	
			Benzene	2016/11/02	<0.0090		ug	
			1,1,2-Trichloroethane	2016/11/02	<0.016		ug	
			1,2-Dichloropropane	2016/11/02	<0.011		ug	
			Trichloroethylene	2016/11/02	<0.011		ug	
			Toluene	2016/11/02	<0.014		ug	
			Tetrachloroethylene	2016/11/02	<0.018		ug	
			Chlorobenzene	2016/11/02	<0.011		ug	

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Client Project #: 106377(16-167)
Site Location: ARCELLOR MITTAL

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Ethylbenzene	2016/11/02	<0.014		ug	
			m / p-Xylene	2016/11/02	<0.015		ug	
			Styrene	2016/11/02	<0.012		ug	
			o-Xylene	2016/11/02	<0.015		ug	
			Bromoform	2016/11/02	<0.014		ug	
			1,1,2,2-Tetrachloroethane	2016/11/02	<0.014		ug	
			Acrylonitrile	2016/11/02	<0.025		ug	
4731750	YYA	Spiked Blank	Bromofluorobenzene	2016/11/03		99	%	43 - 131
			D10-Ethylbenzene (FS)	2016/11/03		98	%	47 - 157
			D4-1,2-Dichloroethane	2016/11/03		98	%	64 - 133
			D8-Toluene	2016/11/03		100	%	68 - 121
			Chloromethane	2016/11/03		90	%	50 - 150
			Vinyl Chloride	2016/11/03		88	%	50 - 150
			Bromomethane	2016/11/03		85	%	50 - 150
			Chloroethane	2016/11/03		92	%	50 - 150
			1,1-Dichloroethylene	2016/11/03		99	%	50 - 150
			Iodomethane	2016/11/03		88	%	N/A
			Carbon Disulfide	2016/11/03		90	%	50 - 150
			Methylene Chloride(Dichloromethane)	2016/11/03		95	%	50 - 150
			Chloroform	2016/11/03		97	%	50 - 150
			1,2-Dichloroethane	2016/11/03		98	%	50 - 150
			1,1,1-Trichloroethane	2016/11/03		97	%	50 - 150
			Carbon Tetrachloride	2016/11/03		97	%	50 - 150
			Benzene	2016/11/03		99	%	50 - 150
			1,1,2-Trichloroethane	2016/11/03		101	%	50 - 150
			1,2-Dichloropropane	2016/11/03		100	%	50 - 150
			Trichloroethylene	2016/11/03		99	%	50 - 150
			Toluene	2016/11/03		99	%	50 - 150
			Tetrachloroethylene	2016/11/03		102	%	50 - 150
			Chlorobenzene	2016/11/03		101	%	50 - 150
			Ethylbenzene	2016/11/03		100	%	50 - 150
			m / p-Xylene	2016/11/03		101	%	50 - 150
			Styrene	2016/11/03		102	%	50 - 150
			o-Xylene	2016/11/03		102	%	50 - 150
			Bromoform	2016/11/03		102	%	50 - 150
			1,1,2,2-Tetrachloroethane	2016/11/03		101	%	50 - 150
			Acrylonitrile	2016/11/03		86	%	N/A
4731750	YYA	Method Blank	Bromofluorobenzene	2016/11/03		98	%	43 - 131
			D10-Ethylbenzene (FS)	2016/11/03		99	%	47 - 157
			D4-1,2-Dichloroethane	2016/11/03		108	%	64 - 133
			D8-Toluene	2016/11/03		100	%	68 - 121
			Chloromethane	2016/11/03	<0.015		ug	
			Vinyl Chloride	2016/11/03	<0.013		ug	
			Bromomethane	2016/11/03	<0.015		ug	
			Chloroethane	2016/11/03	<0.0090		ug	
			1,1-Dichloroethylene	2016/11/03	<0.011		ug	
			Iodomethane	2016/11/03	<0.015		ug	
			Carbon Disulfide	2016/11/03	<0.026		ug	
			Methylene Chloride(Dichloromethane)	2016/11/03	<0.019		ug	
			Chloroform	2016/11/03	<0.011		ug	
			1,2-Dichloroethane	2016/11/03	<0.0070		ug	
			1,1,1-Trichloroethane	2016/11/03	<0.014		ug	
			Carbon Tetrachloride	2016/11/03	<0.016		ug	

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Site Location: ARCELLOR MITTAL

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Benzene	2016/11/03	<0.0090		ug	
			1,1,2-Trichloroethane	2016/11/03	<0.016		ug	
			1,2-Dichloropropane	2016/11/03	<0.011		ug	
			Trichloroethylene	2016/11/03	<0.011		ug	
			Toluene	2016/11/03	<0.014		ug	
			Tetrachloroethylene	2016/11/03	<0.018		ug	
			Chlorobenzene	2016/11/03	<0.011		ug	
			Ethylbenzene	2016/11/03	<0.014		ug	
			m / p-Xylene	2016/11/03	<0.015		ug	
			Styrene	2016/11/03	<0.012		ug	
			o-Xylene	2016/11/03	<0.015		ug	
			Bromoform	2016/11/03	<0.014		ug	
			1,1,2,2-Tetrachloroethane	2016/11/03	<0.014		ug	
			Acrylonitrile	2016/11/03	<0.025		ug	
4733462	YYA	Spiked Blank	4-Bromofluorobenzene	2016/11/04		87	%	70 - 130
			D4-1,2-Dichloroethane	2016/11/04		106	%	70 - 130
			D8-Toluene	2016/11/04		107	%	70 - 130
			Chloromethane	2016/11/04		111	%	60 - 140
			Vinyl Chloride	2016/11/04		149 (1)	%	70 - 130
			Bromomethane	2016/11/04		101	%	60 - 140
			Chloroethane	2016/11/04		106	%	70 - 130
			Iodomethane	2016/11/04		79	%	N/A
			Carbon Disulfide	2016/11/04		106	%	N/A
			Methylene Chloride(Dichloromethane)	2016/11/04		97	%	70 - 130
			1,1-Dichloroethane	2016/11/04		99	%	70 - 130
			Chloroform	2016/11/04		99	%	70 - 130
			1,2-Dichloroethane	2016/11/04		102	%	70 - 130
			1,1,1-Trichloroethane	2016/11/04		108	%	70 - 130
			Carbon Tetrachloride	2016/11/04		115	%	70 - 130
			Benzene	2016/11/04		98	%	70 - 130
			1,2-Dichloropropane	2016/11/04		92	%	70 - 130
			Trichloroethylene	2016/11/04		93	%	70 - 130
			Toluene	2016/11/04		103	%	70 - 130
			Tetrachloroethylene	2016/11/04		91	%	70 - 130
			Chlorobenzene	2016/11/04		95	%	70 - 130
			Ethylbenzene	2016/11/04		107	%	70 - 130
			p+m-Xylene	2016/11/04		101	%	70 - 130
			Styrene	2016/11/04		97	%	70 - 130
			o-Xylene	2016/11/04		97	%	70 - 130
			Bromoform	2016/11/04		78	%	70 - 130
			1,1,2,2-Tetrachloroethane	2016/11/04		99	%	70 - 130
			Total Xylenes	2016/11/04		99	%	N/A
4733462	YYA	Method Blank	4-Bromofluorobenzene	2016/11/04		82	%	70 - 130
			D4-1,2-Dichloroethane	2016/11/04		105	%	70 - 130
			D8-Toluene	2016/11/04		111	%	70 - 130
			Chloromethane	2016/11/04	<2.0		ug/L	
			Vinyl Chloride	2016/11/04	<0.40		ug/L	
			Bromomethane	2016/11/04	<3.0		ug/L	
			Chloroethane	2016/11/04	<1.0		ug/L	
			Iodomethane	2016/11/04	<0.60		ug/L	
			Carbon Disulfide	2016/11/04	<0.50		ug/L	
			Methylene Chloride(Dichloromethane)	2016/11/04	<1.0		ug/L	
			1,1-Dichloroethane	2016/11/04	<0.40		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Chloroform	2016/11/04	<0.40		ug/L	
			1,2-Dichloroethane	2016/11/04	<0.50		ug/L	
			1,1,1-Trichloroethane	2016/11/04	<0.50		ug/L	
			Carbon Tetrachloride	2016/11/04	<0.50		ug/L	
			Benzene	2016/11/04	<0.50		ug/L	
			1,2-Dichloropropane	2016/11/04	<0.50		ug/L	
			Trichloroethylene	2016/11/04	<0.50		ug/L	
			Toluene	2016/11/04	<0.50		ug/L	
			Tetrachloroethylene	2016/11/04	<0.50		ug/L	
			Chlorobenzene	2016/11/04	<0.50		ug/L	
			Ethylbenzene	2016/11/04	<0.50		ug/L	
			p+m-Xylene	2016/11/04	<0.50		ug/L	
			Styrene	2016/11/04	<0.50		ug/L	
			o-Xylene	2016/11/04	<0.50		ug/L	
			Bromoform	2016/11/04	<0.40		ug/L	
			1,1,2,2-Tetrachloroethane	2016/11/04	<1.0		ug/L	
			Total Xylenes	2016/11/04	<0.50		ug/L	

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Maureen Smith

Maureen Smith, Supervisor, Volatiles

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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Method 15

QUENCH TOWER GAS
HYDROGEN SULFIDE ANALYTICAL REPORT
ARCELOMITTAL - 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

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.

QUENCH TOWER GAS
HYDROGEN SULFIDE ANALYTICAL REPORT
ARCELORMITTAL - MONESSEN, MONESSEN, PA

Project No. 16-167

1·3·2017

Date

Frank Barton, Field Project Manager
Montrose Air Quality Services, LLC.

1/3/17

Date

Matthew Dallesasse, District Manager
Montrose Air Quality Services, LLC.

Disclaimer – This document is intended solely for the use of the individual to whom it is addressed and others authorized to receive it.

Table 1. Analysis of Quench Tower Gas for Hydrogen Sulfide (H2S)
Test Dates November 1 through November 2, 2016
Quench Tower, ArcelorMittal - Monessen, Monessen, PA

	Start Time	End Time	Run Average
Run 1	11/1/16 8:50	11/1/16 12:53	< 0.5 ppm
Run 2	11/1/16 13:28	11/1/16 17:42	< 0.5 ppm
Run 3	11/2/16 7:42	11/2/16 12:11	< 0.5 ppm
			Average of Runs 1 - 3
			< 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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B: Calibration Gas Certificates
C: H2S Calibration Data
D: Runs 1-3 Data
E: Citrate Buffer Verification Files

QENCH TOWER GAS
HYDROGEN SULFIDE ANALYTICAL REPORT
ARCELORMITTAL - MONESSEN, MONESSEN, PA

METHOD NARRATIVE

Gas chromatography (GC) analysis was performed on gas created during a Quench from the Quench Tower 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 runs. Because emissions are released only during quenches, sampling was done during quenches. Each run consisted of fifteen quenches. Three or four sample injections were taken during each quench. Samples were injected at the start of the hot car entering the Quench Tower and every one and half to two minutes during the quench.

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%. The sampling occurred over a two day period. The initial calibration was verified by injecting one H2S calibration gas level at the end of each run.

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 a Quench Tower 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

Quench Tower

Date	Quench			Run 1				
11/1/2016		Start time	Stop	Injection				
	1	8:50:00	8:58:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	2	9:11:00	9:16:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	3	9:27:00	9:31:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
	4	9:39:00	9:45:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	5	10:01:00	10:07:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	6	10:18:00	10:24:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	7	10:32:00	10:35:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
	8	10:45:00	10:50:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm

Quench Tower

Date	Quench			Run 1				
11/1/2016		Start time	Stop	Injection				
	9	10:59:00	11:04:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	10	11:12:00	11:14:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
	11	11:56:00	12:01:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	12	12:10:00	12:15:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	13	12:22:00	12:27:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	14	12:37:00	12:42:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	15	12:49:00	12:53:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm

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Quench Tower

Date	Quench			Run 2				
11/1/2016		Start time	Stop	Injection				
	1	13:28:00	13:34:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	2	13:04:00	13:45:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	3	14:15:00	14:20:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	4	14:27:00	14:32:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	5	14:39:00	14:44:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	6	14:52:00	14:57:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	7	15:05:00	15:10:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	8	15:18:00	15:23:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm

Quench Tower

Date	Quench			Run 2				
11/1/2016		Start time	Stop	Injection				
	9	15:37:00	15:42:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	10	15:49:00	15:54:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	11	16:02:00	16:07:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	12	16:48:00	16:50:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	13	17:12:00	17:18:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	14	17:25:00	17:30:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	15	17:37:00	17:42:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm

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Quench Tower

Run 3

Date	Quench	Start time	Stop	Injection	Component	Retention	Area	External
11/2/2016	1	7:42:00	7:47:00					
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	2	7:55:00	8:01:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	3	8:08:00	8:10:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	4	8:24:00	8:29:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	5	9:05:00	9:10:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	6	9:22:00	9:27:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	7	9:35:00	9:40:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	8	9:51:00	9:57:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm

Quench Tower

Run 3

Date	Quench	Start time	Stop	Injection	Component	Retention	Area	External
11/2/2016	9	10:03:00	10:08:00	1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	10	10:19:00	10:24:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	11	10:29:00	10:34:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	12	10:42:00	10:47:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	13	10:54:00	10:59:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	14	11:52:00	11:57:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 ppm
	15	12:06:00	12:11:00		Component	Retention	Area	External
				1	H2S	-	-	< 0.5 ppm
				2	H2S	-	-	< 0.5 ppm
				3	H2S	-	-	< 0.5 ppm
				4	H2S	-	-	< 0.5 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

CS Williams
Approved for Release

Airgas

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Airgas, Inc.
600 Union Landing Road
Cinnaminson, NJ 08077
856-829-7878 Fax: 856-829-6576
Airgas.com

Part Number:	E02NI99E15A0445	Reference Number:	82-124479697-1
Cylinder Number:	CC448299	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Riverton - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52015	Valve Outlet:	330
Gas Code:	H2S,BALN	Certification Date:	Mar 05, 2015

Expiration Date: Mar 05, 2018

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
HYDROGEN SULFIDE	150.0 PPM	145.2 PPM	G1	+/- 0.7%	02/26/2015, 03/05/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124395711102	CC365062	201.5 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.6%	Oct 16, 2017
RGM	12344	XC028492B	197.3 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.5%	Nov 12, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Ametek 9000 RM	NDUV	Feb 25, 2015

Triad Data Available Upon Request

Approved for Release

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**	November 1 through November 2, 2016
Project No	16-167	**Run 1**	Start: 11-1-2016 8:50 / End: 11-01-2016 12:53
Plant	Monessen	**Run 2**	Start: 11-1-2016 13:28 / End: 11-01-2016 17:42
Unit	Quench Tower	**Run 3**	Start: 11-2-2016 7:42 / End: 11-02-2016 12:11
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**	10.5394	10.1418	10.3010	10.3274	2.05%	1.80%	0.26%
	Mid	503.4460	512.7672	501.7190	505.9774	0.50%	1.34%	0.84%
	High	3864.2228	3802.9777	3807.1922	3824.7976	1.03%	0.57%	0.46%
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**	10.5416	10.3875	10.2508	10.3933	1.43%	0.06%	1.37%
	Mid	508.1406	506.8499	498.7954	504.5953	0.70%	0.45%	1.15%
	High	3831.9790	3844.7651	3944.4383	3873.7275	1.08%	0.75%	1.83%
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**	10.54	10.54		
		10.14	10.39		
		10.30	10.25		
	Average	10.33	10.39	0.6%	YES

		Pre Calibration	Post Calibration	% of Average	Less than 5%
56.0	**ppm H2S**	503.45	508.14		
		512.77	506.85		
		501.72	498.80		
	Average	505.98	504.60	0.3%	YES

		Pre Calibration	Post Calibration	% of Average	Less than 5%
145.2	**ppm H2S**	3864.22	3831.98		
		3802.98	3844.77		
		3807.19	3944.44		
	Average	3824.80	3873.73	1.3%	YES

POST TEST LINE LOSS CHECK

10.0 ppm	**Average**	**Area**	**% of Average**
	1	10.3872	1.79%
	2	10.7305	1.45%
	3	10.6125	0.34%
	Average	**10.5767**	

	Area
Calibration Standard	10.3
Post Test Line Loss Injection Average	10.6
Post Test Line Loss	-2.41%

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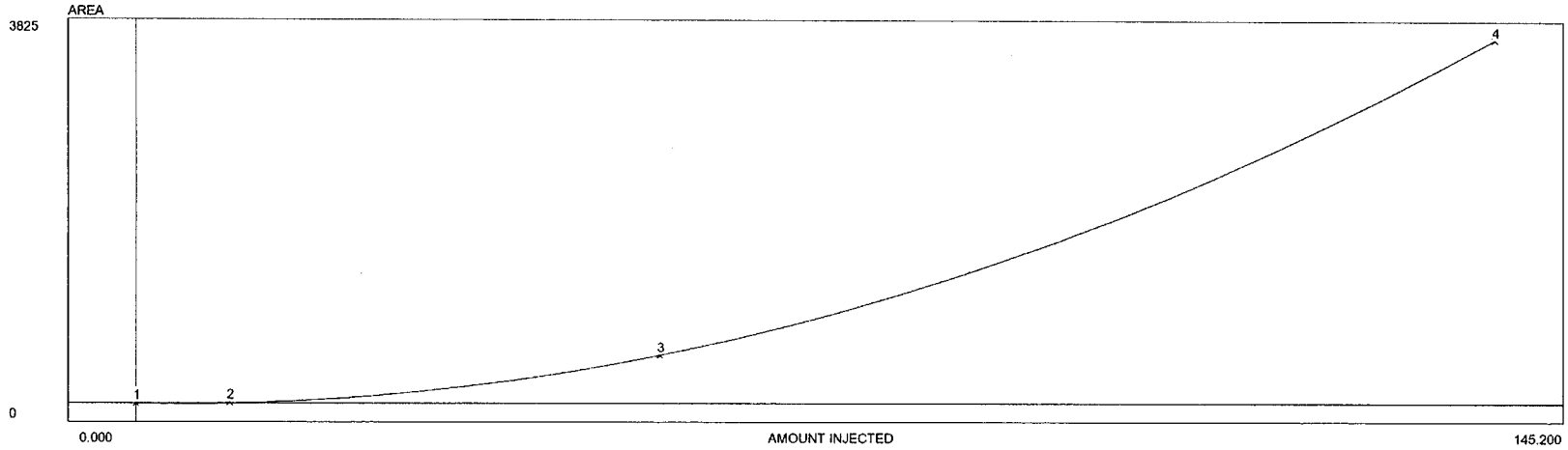
Calibration file: C:\Users\GC 1\Desktop\Projects\Monessen\16-167\10-31 through 11-3 2016 Quench tower\H2S Cal 11-01-2016.cal



Avg slope of curve: 26.34
Y-axis intercept: 0.00
Linearity: 0.49
Number of levels: 4
SD/rel SD of CF's: 12.2/133.8
Y=0.1935X²+-1.7607X
r2: 1.0000
Last calibrated: Tue Nov 01 08:38:16 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	10.327	9.994	1.033	10.327	N/A	N/A
3	505.977	56.000	9.035	505.977	N/A	N/A
4	3824.798	145.200	26.342	3824.798	N/A	N/A

11-01-2016 H2S Cal Curve

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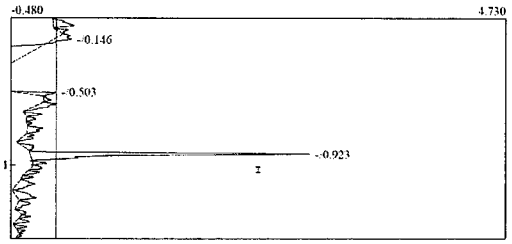
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:27:07
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Zero Cal 01
Comments: Ambient Air

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

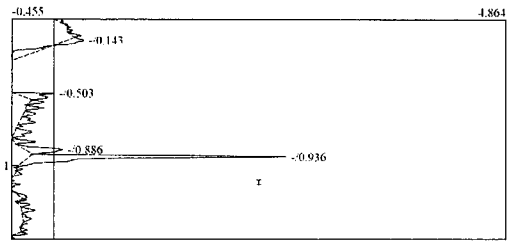
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:29:17
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Zero Cal 02
Comments: Ambient Air

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

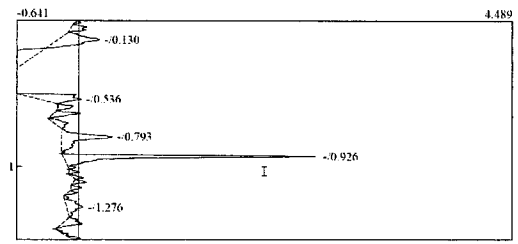
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:31:47
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Zero Cal 03
Comments: Ambient Air

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

Zero Cal

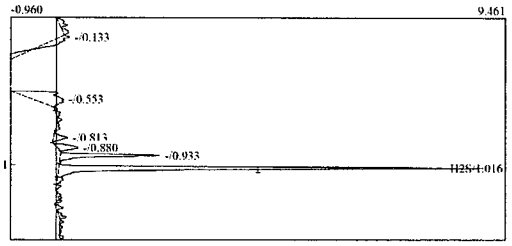
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:49:01
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Low Cal 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.016	10.5394
		10.5394

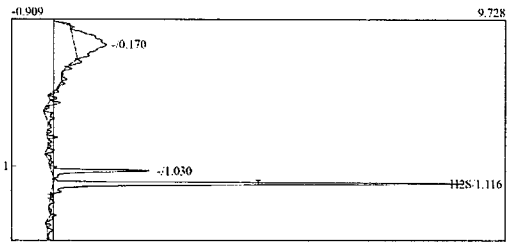
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:51:52
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Low Cal 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.116	10.1418
		10.1418

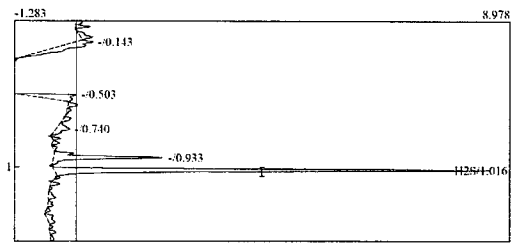
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:54:03
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Low Cal 03
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.016	10.3010
		10.3010

H2S Low Cal

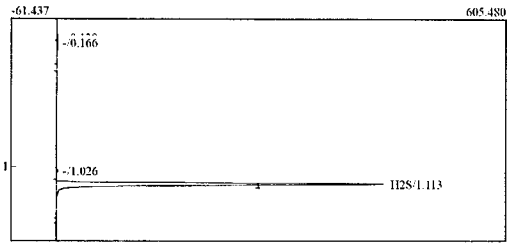
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:31:34
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Mid Cal 01
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.113	503.4460
		503.4460

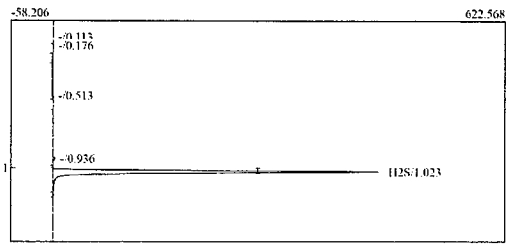
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:33:39
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Mid Cal 02
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.023	512.7672
		512.7672

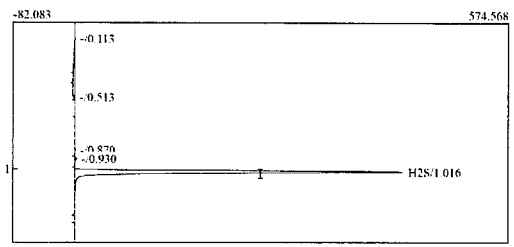
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:35:53
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Mid Cal 03
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.016	501.7190
		501.7190

H2S Mid Cal

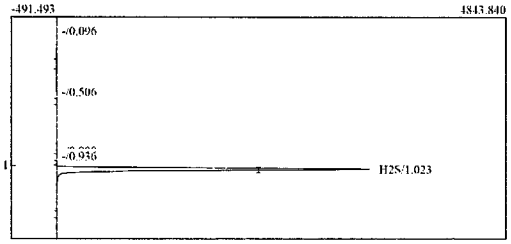
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:14:23
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S High Cal 01
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.023	3864.2228
		3864.2228

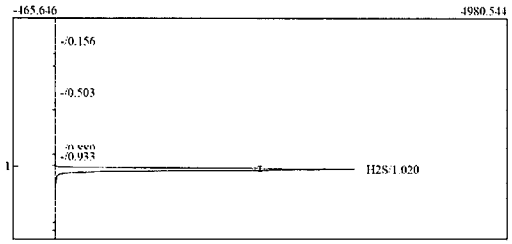
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:16:32
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S High Cal 02
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.020	3802.9777
		3802.9777

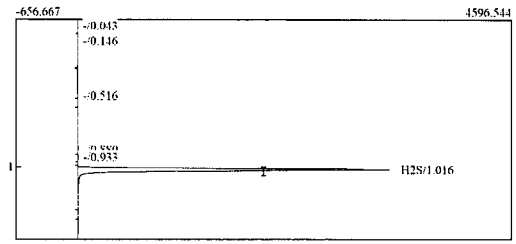
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 07:18:45
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S High Cal 03
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.016	3807.1922
		3807.1922

H2S High Cal

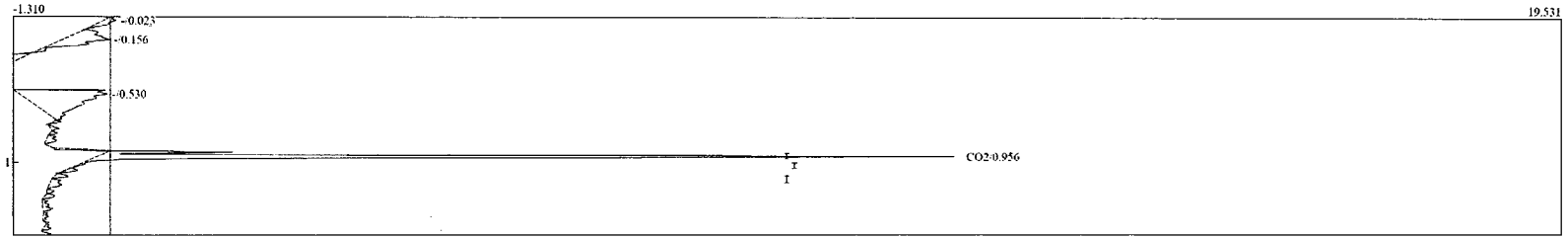
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:06:39
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: CO2 Timecheck

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
CO2	0.956	14.0090
		14.0090

CO2 Timecheck

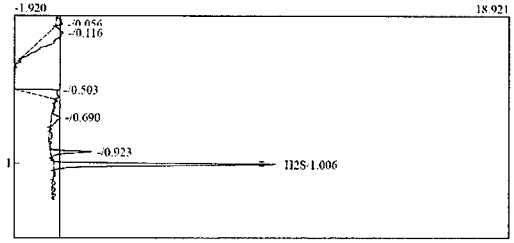
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 13:25:22
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post Low Cal 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.006	10.5416
		10.5416

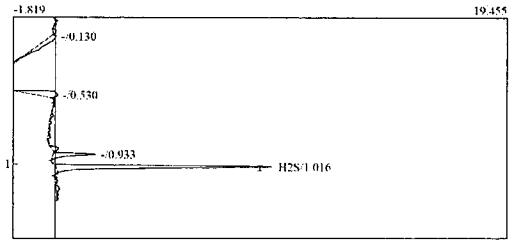
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 13:27:31
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post Low Cal 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.016	10.3875
		10.3875

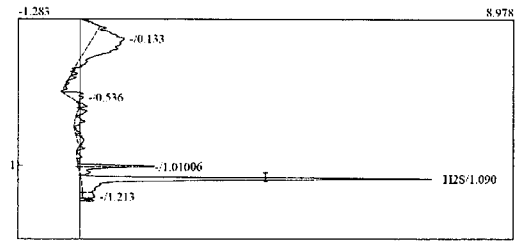
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 13:22:30
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post Low Cal 03
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.090	9.8202
		9.8202

H2S Post Low Cal

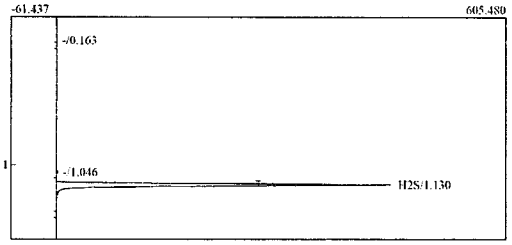
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:41:58
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Mid Post Cal 01
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.130	508.1406
		508.1406

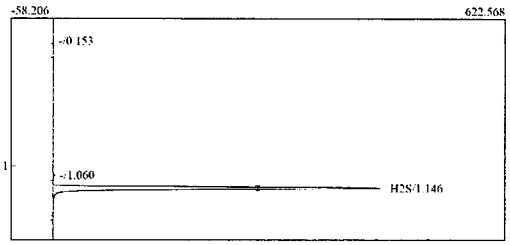
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:43:40
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Mid Post Cal 02
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.146	506.8499
		506.8499

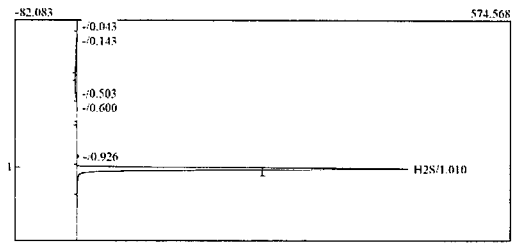
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:46:54
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Mid Post Cal 03
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.010	498.7954
		498.7954

H2S Post Mid Cal

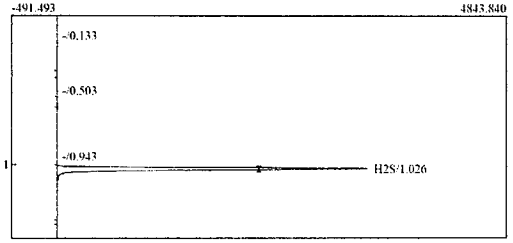
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:57:50
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post High Cal 01
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.026	3831.9790
		3831.9790

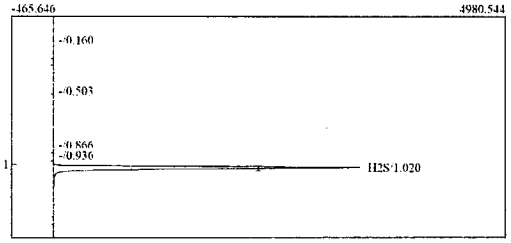
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:53:15
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post High Cal 02
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.020	3844.7651
		3844.7651

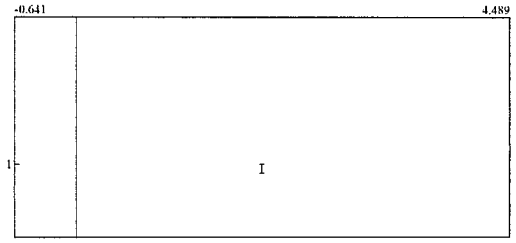
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:57:50
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post High Cal 03
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

H2S Post High Cal

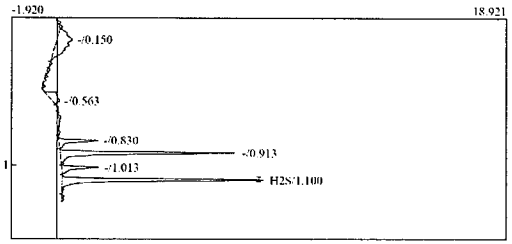
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 13:52:48
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post Line Loss 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.100	10.3872
		10.3872

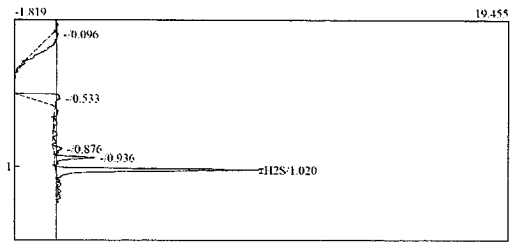
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 13:54:47
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post Line Loss 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.020	10.7305
		10.7305

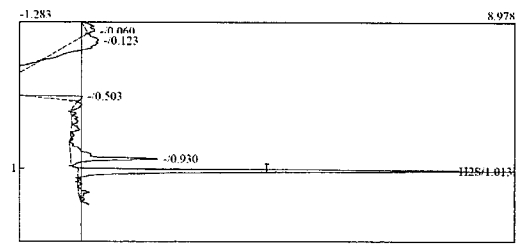
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 13:56:52
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower H2S Post Line Loss 03
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.013	10.6125
		10.6125

H2S Post Line Loss

APPENDIX D

Run 1 – 3 DATA

Run Chromatograms

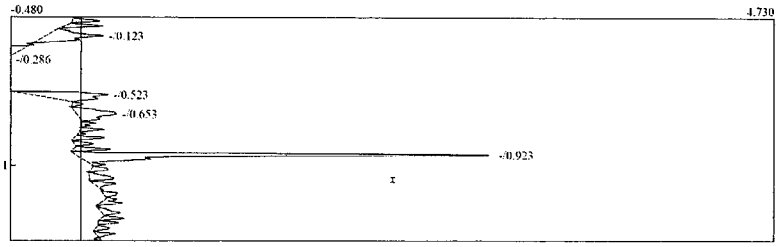
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:50:28
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 1 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

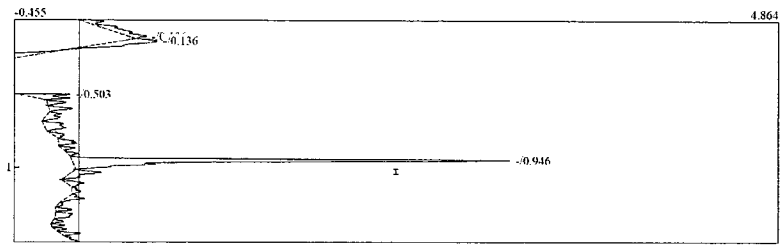
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:52:26
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 1 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 1 Injections 1 - 2

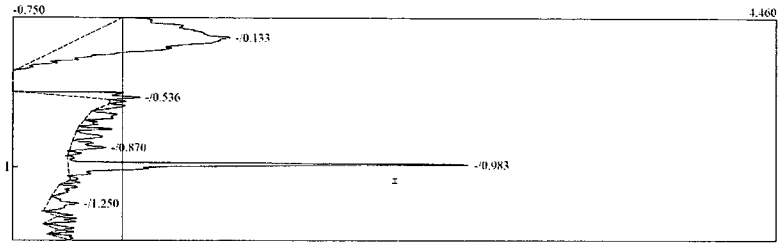
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:56:06
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 1 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

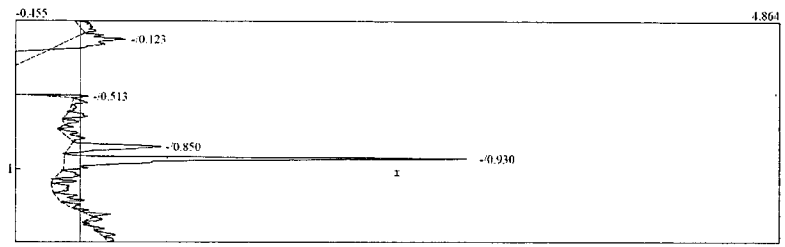
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 08:58:27
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 1 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 1 Injections 3-4

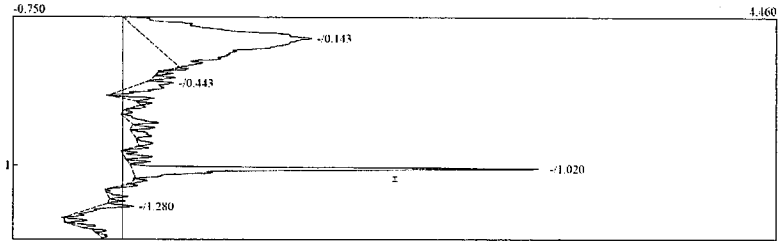
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:10:42
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 2 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

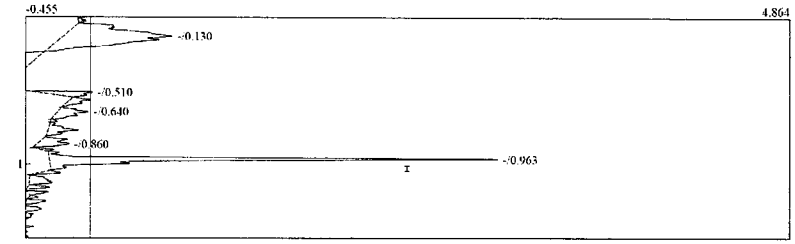
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:12:49
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 2 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 2 Injections 1-2

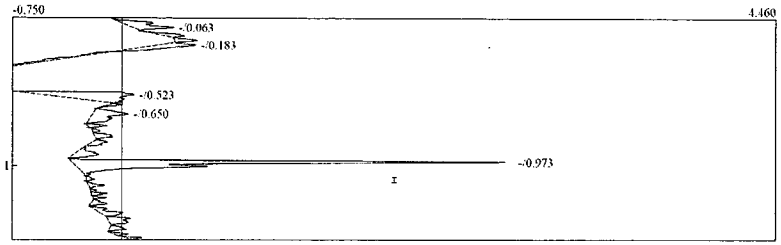
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:14:38
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 2 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

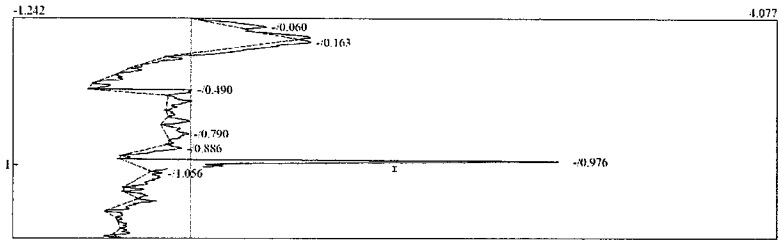
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:16:23
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 2 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 2 Injections 3 - 4

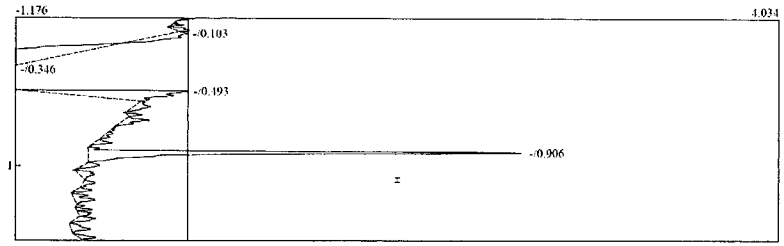
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:27:14
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 3 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

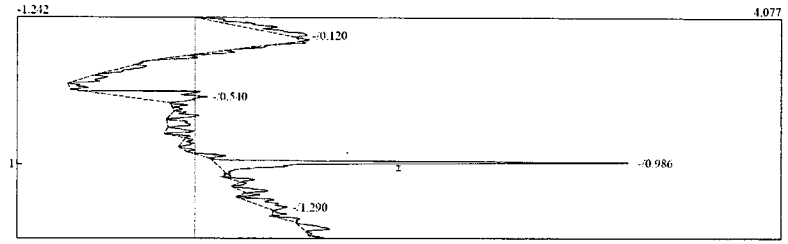
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:28:58
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 3 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 3 Injections 1 - 2

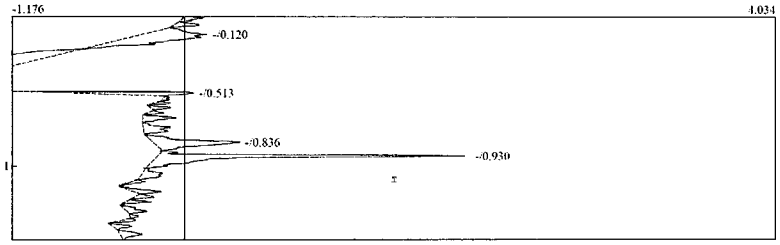
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:31:22
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 3 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

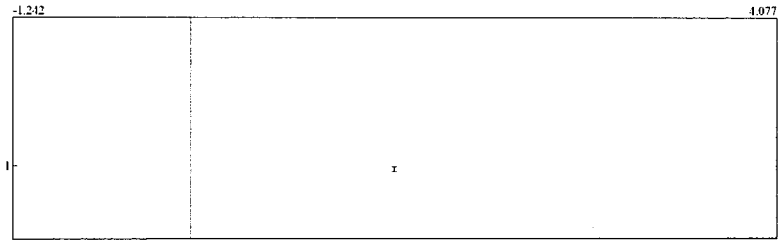
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:28:58
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 3 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 3 Injections 3 - 4

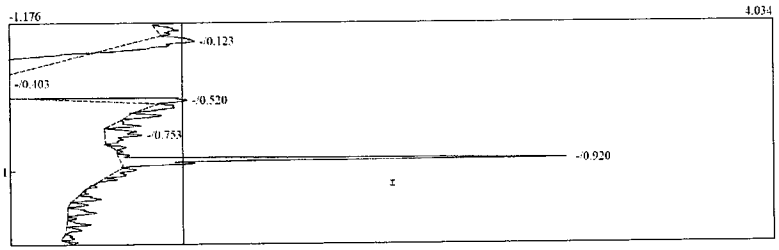
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:39:18
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 4 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

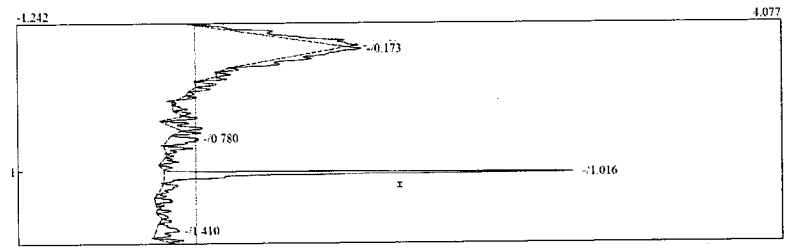
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:41:06
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 4 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 4 Injections 1 - 2

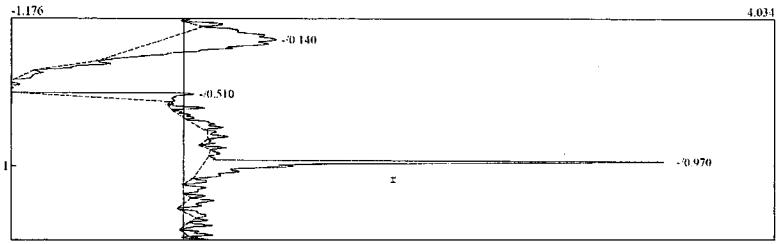
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:42:54
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 4 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

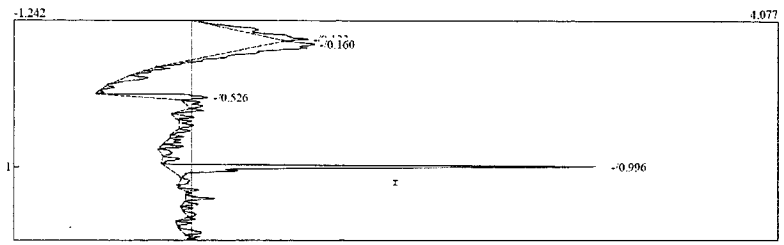
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 09:44:35
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 4 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 4 Injections 3 - 4

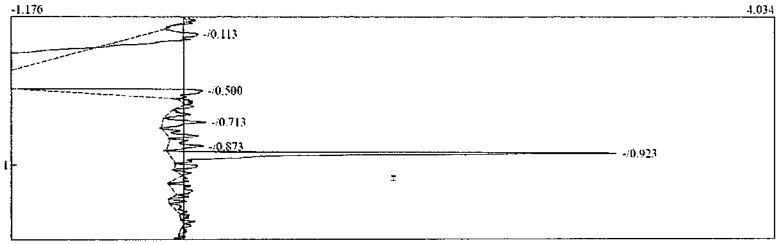
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:01:28
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 5 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

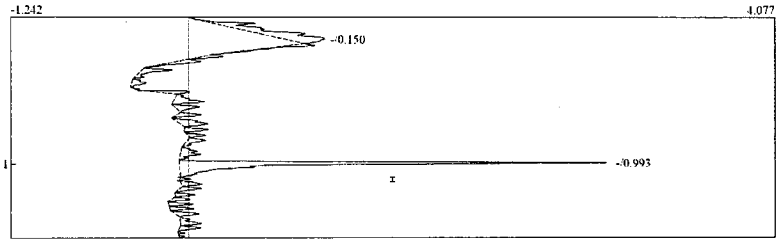
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:03:10
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 5 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 5 Injections 1 - 2

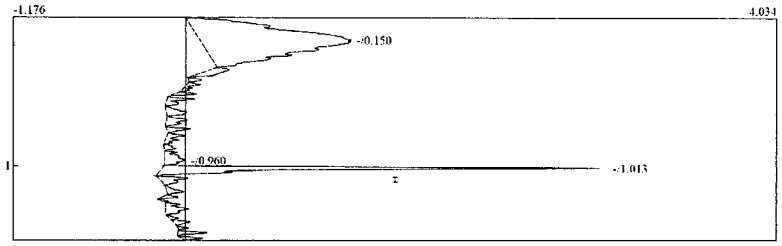
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:04:53
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 5 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

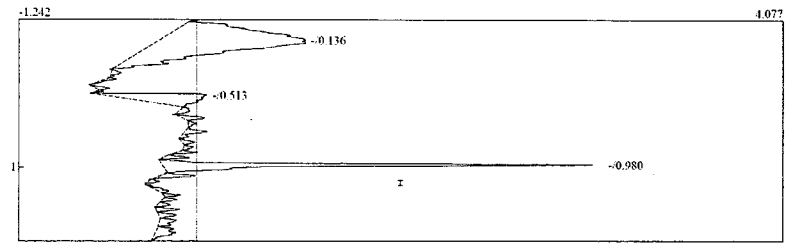
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:06:38
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 5 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 5 Injections 3 - 4

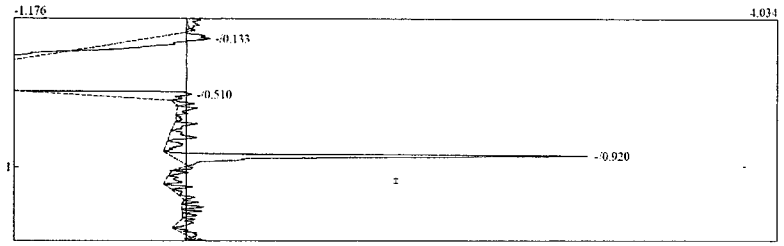
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:18:25
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 6 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

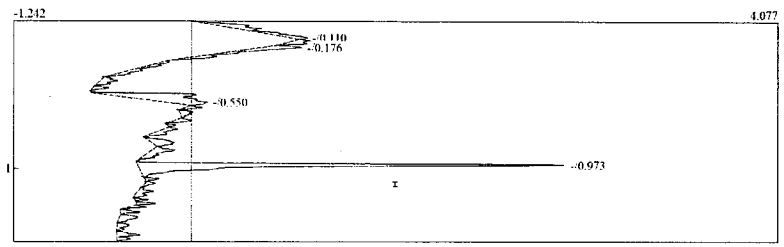
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:20:10
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 6 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 6 Injections 1 - 2

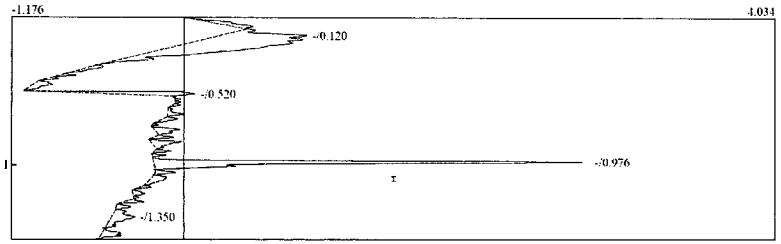
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:21:57
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 6 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

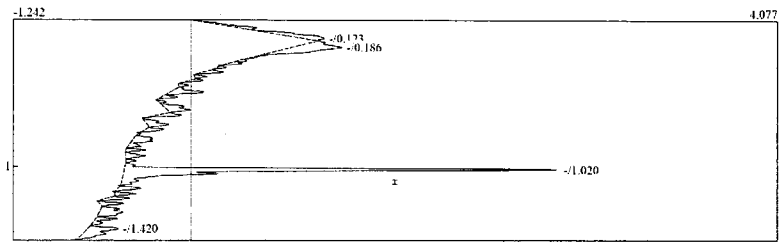
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:23:56
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 6 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 6 Injections 3 - 4

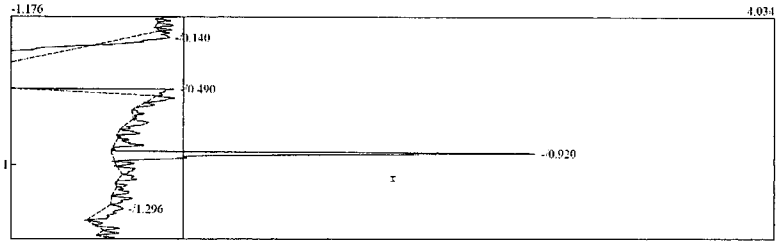
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:31:55
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 7 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

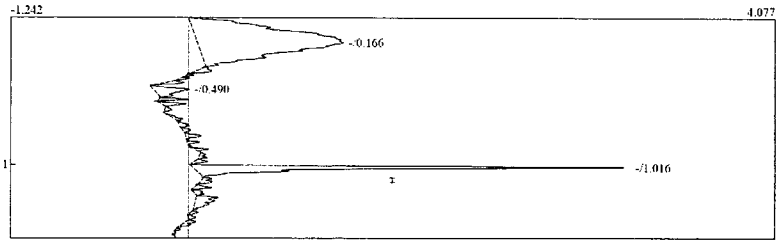
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:33:33
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 7 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 7 Injections 1 - 2

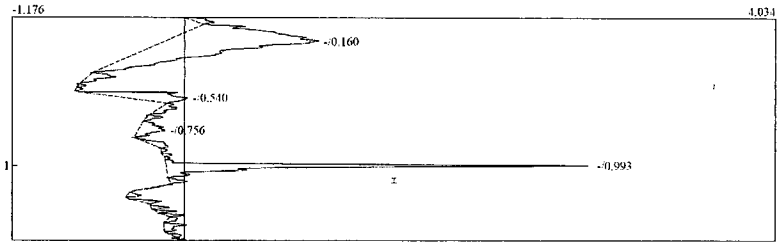
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:35:14
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 7 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

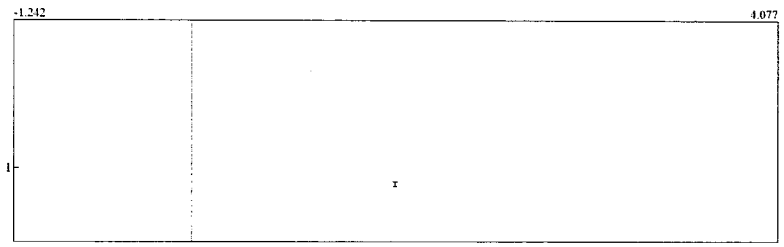
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:33:33
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 7 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 7 Injections 3 - 4

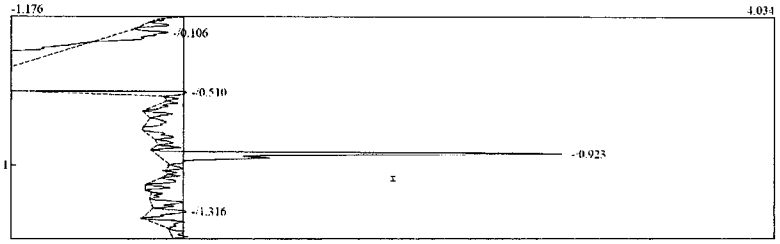
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:44:45
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 8 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

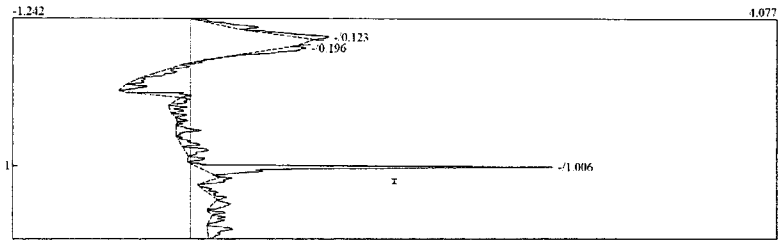
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:46:26
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 8 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 8 Injections 1 - 2

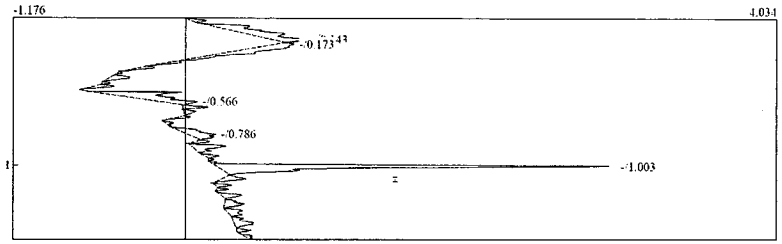
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:48:06
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 8 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

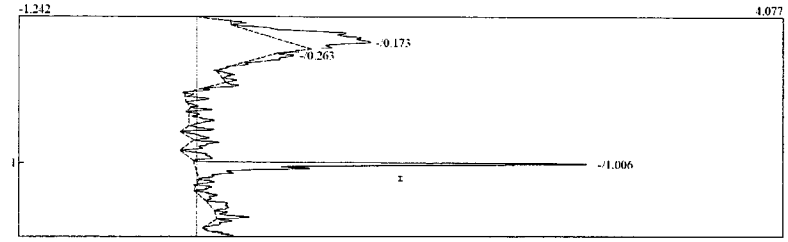
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:49:45
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 8 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 8 Injections 3 - 4

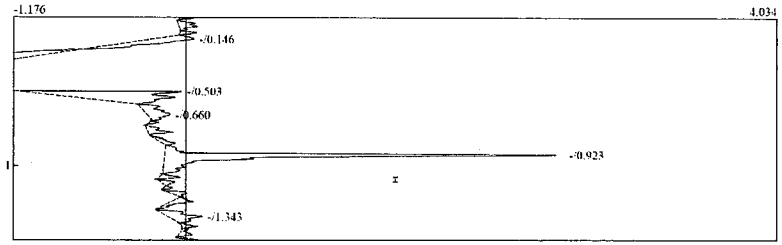
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 10:58:42
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 9 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

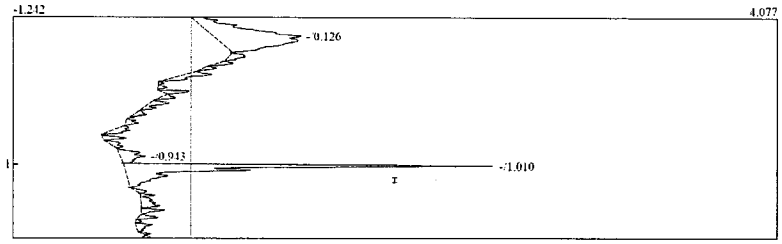
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:00:21
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 MEXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 9 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 9 Injections 1 - 2

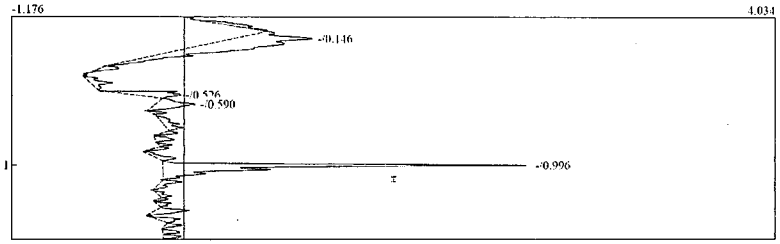
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:02:03
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 9 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

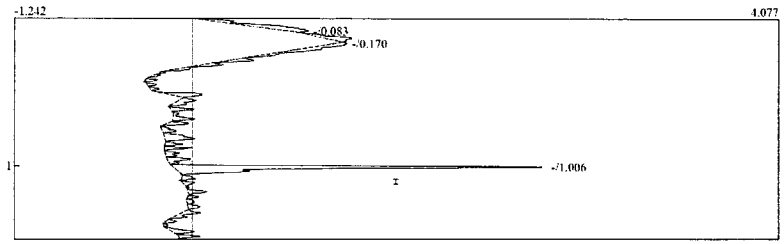
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:03:43
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 9 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 9 Injections 3 - 4

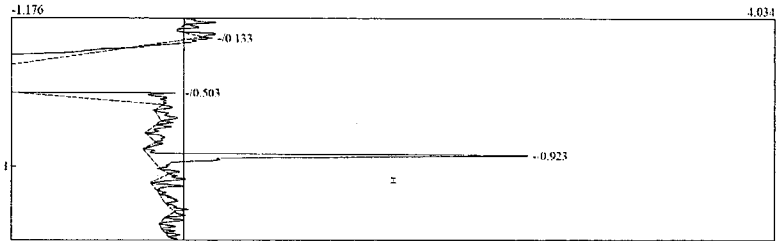
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:12:03
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 10 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

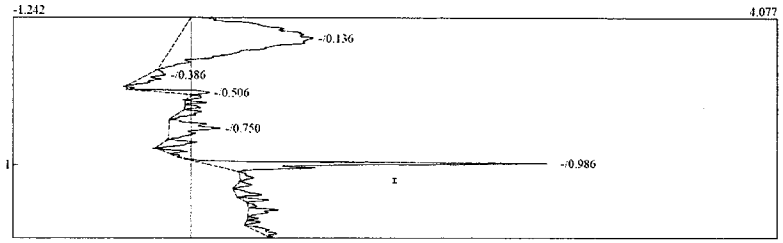
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:13:44
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 10 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 10 Injections 1 - 2

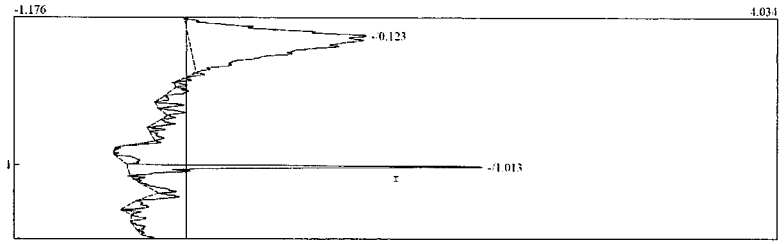
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:15:22
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 10 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

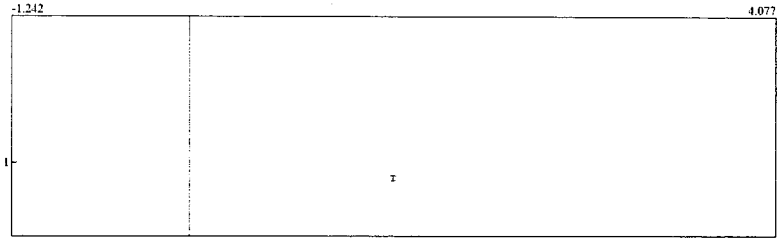
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:13:44
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 10 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 10 Injections 3 - 4

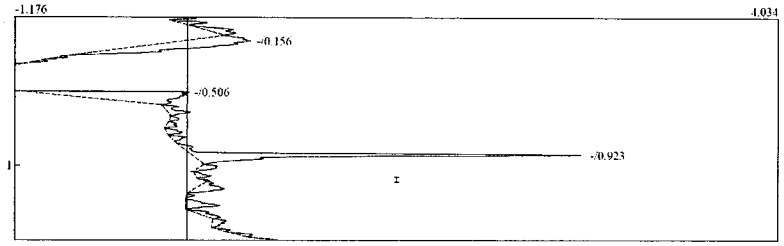
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:55:55
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 11 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

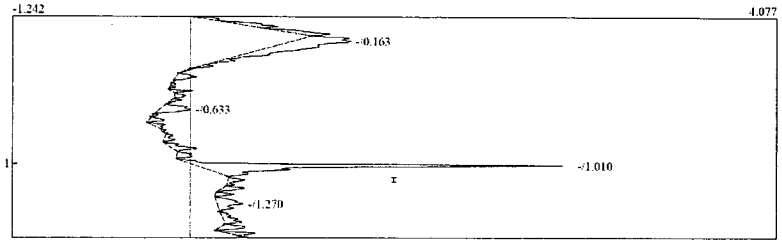
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:57:34
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 11 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 11 Injections 1 - 2

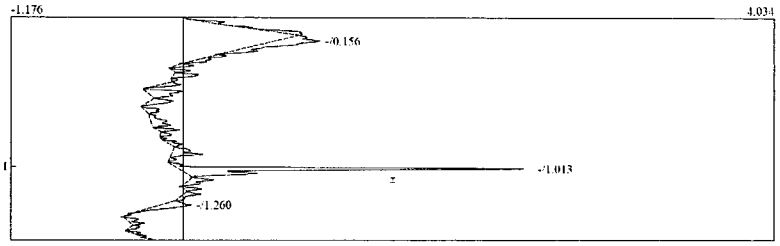
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:59:13
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 11 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

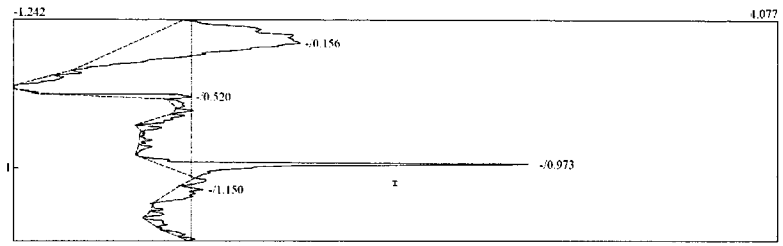
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:01:08
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 11 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 11 Injections 3 - 4

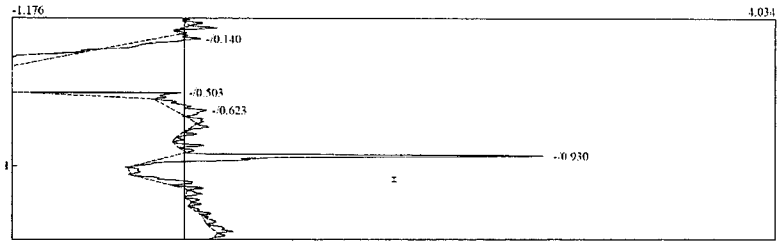
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:09:43
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 12 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

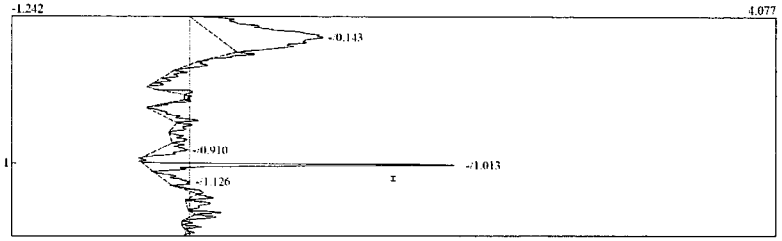
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:11:22
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 12 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 12 Injections 1 - 2

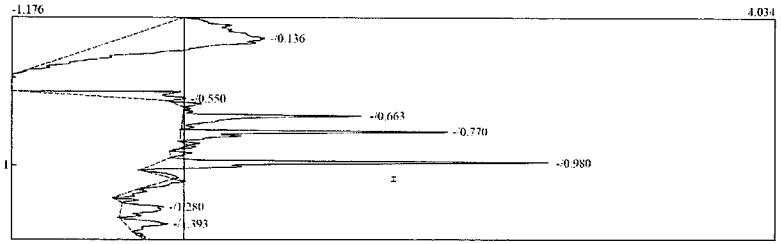
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:13:41
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 12 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

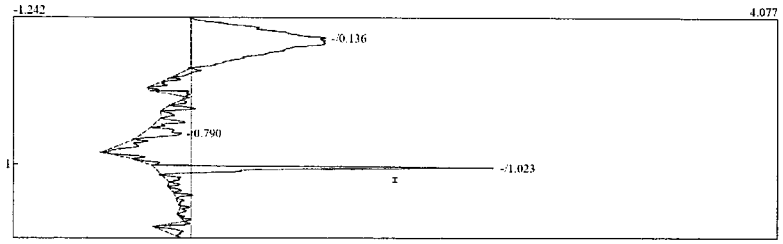
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:15:18
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 12 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 12 Injections 3 - 4

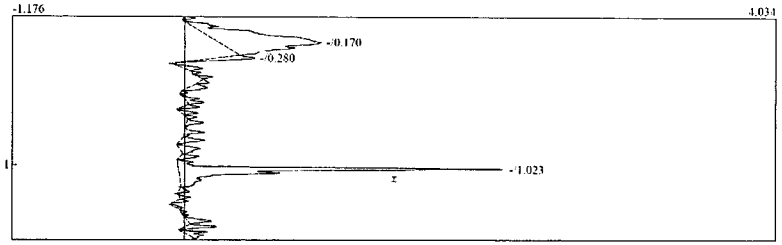
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:22:14
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 13 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

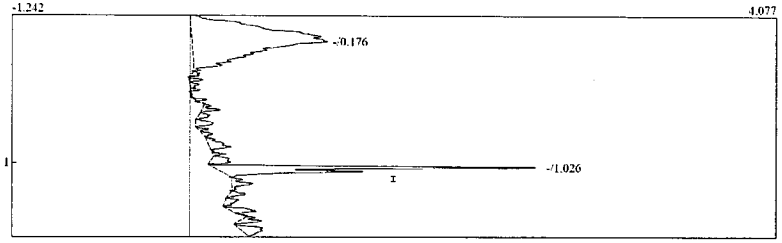
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:23:50
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 13 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 13 Injections 1 - 2

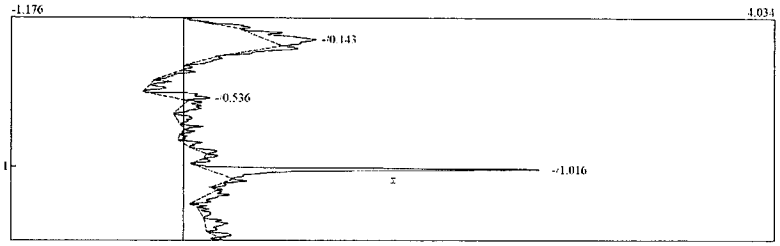
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:25:28
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 13 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

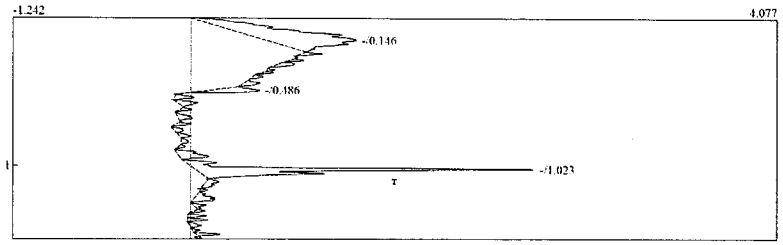
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:27:21
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 13 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 13 Injections 3 - 4

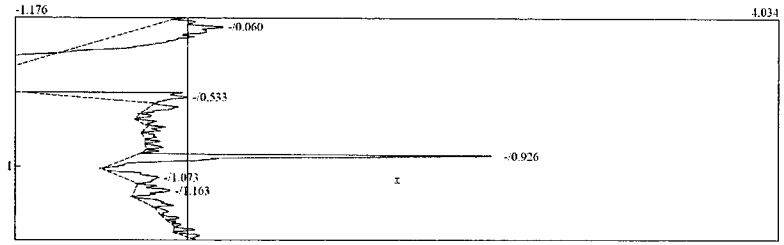
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:36:36
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 14 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

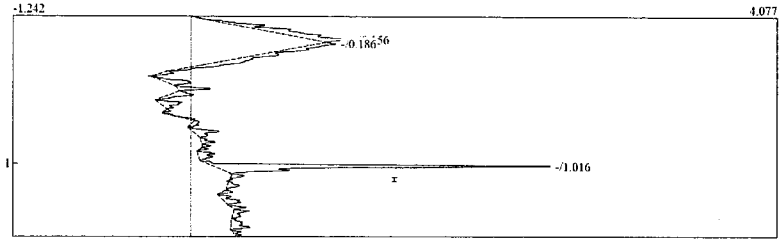
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:38:15
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 14 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 14 Injections 1 - 2

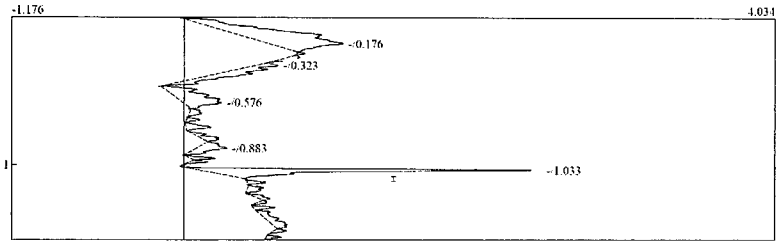
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:39:50
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 14 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

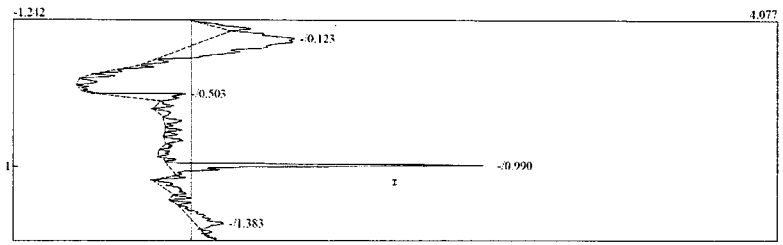
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:41:33
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 14 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 14 Injections 3 - 4

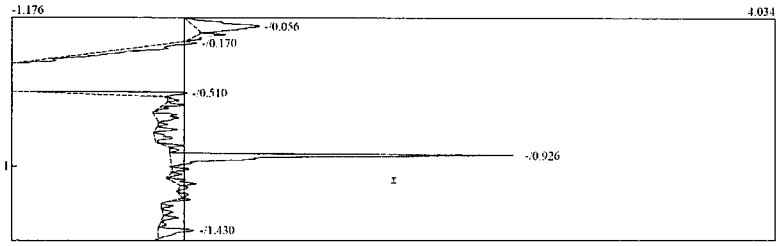
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:48:59
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 15 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

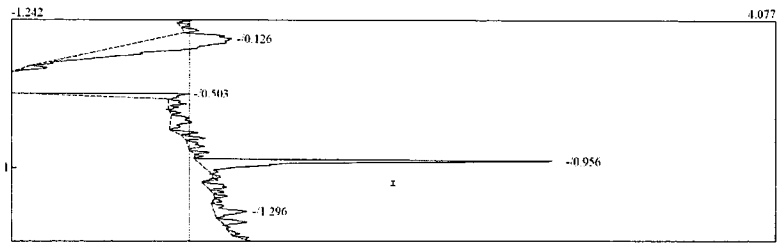
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:50:56
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 15 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 15 Injections 1 - 2

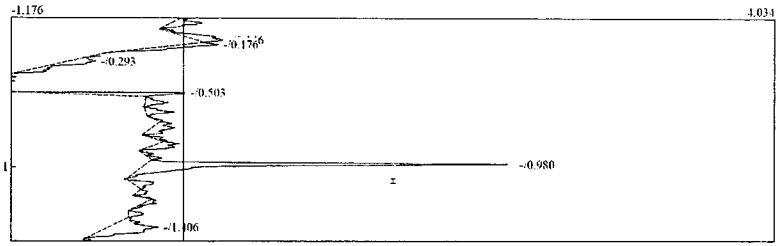
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:52:42
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 15 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

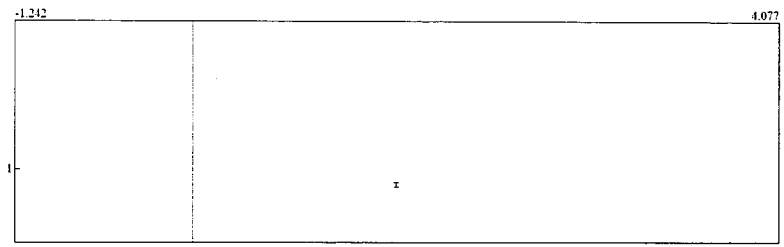
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 12:50:56
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Quench 15 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 1 Quench 15 Injections 3 – 4

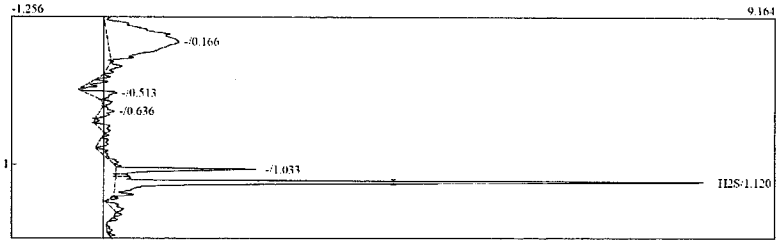
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:20:57
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Low Cal Check 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.120	10.1700
		10.1700

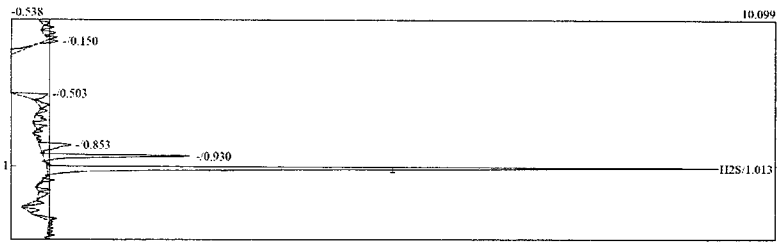
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 11:23:20
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 1 Low Cal Check 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.013	10.6207
		10.6207

Run 1 Quench Tower Low Cal Check

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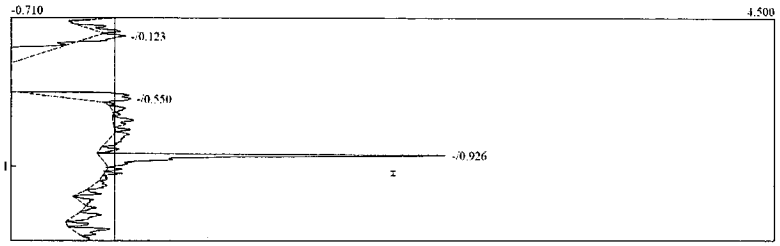
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:27:56
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 1 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

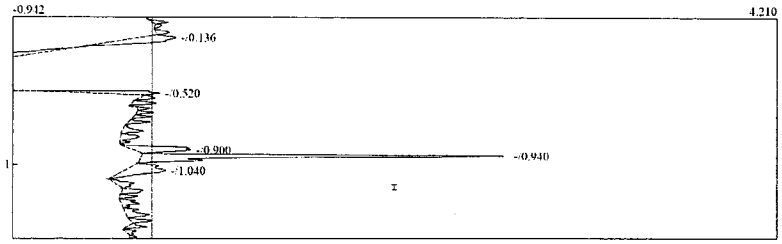
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:30:08
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 1 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 1 Injections 1 - 2

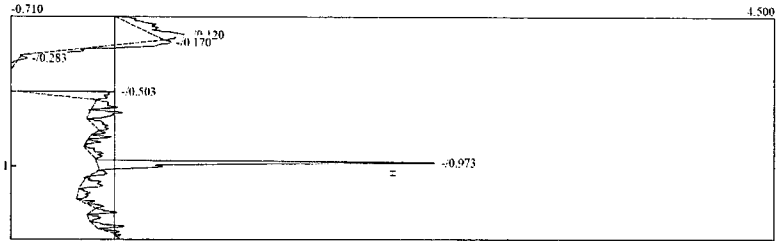
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:31:55
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 1 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

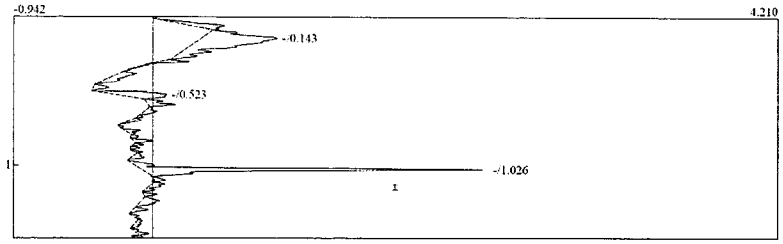
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:33:31
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 1 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 1 Injections 3 - 4

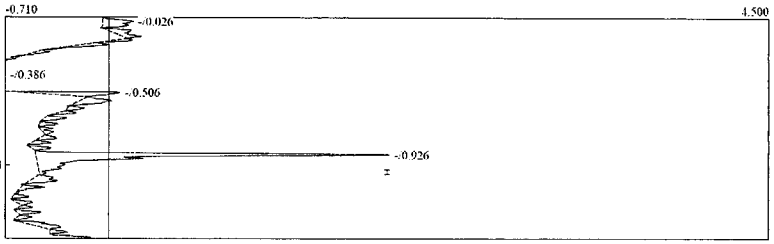
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:40:18
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 2 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

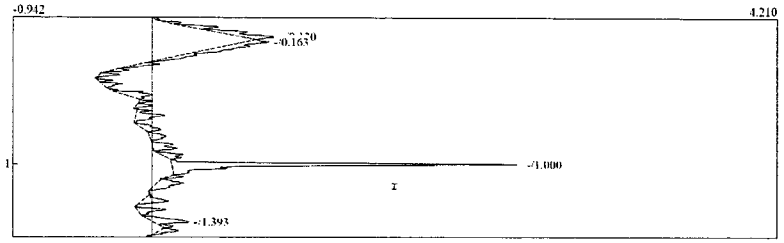
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:41:59
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 2 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 2 Injections 1 - 2

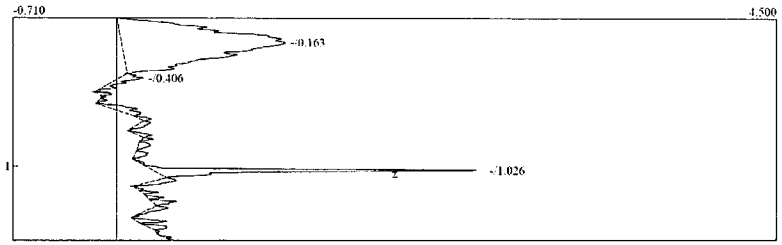
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:43:35
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 2 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

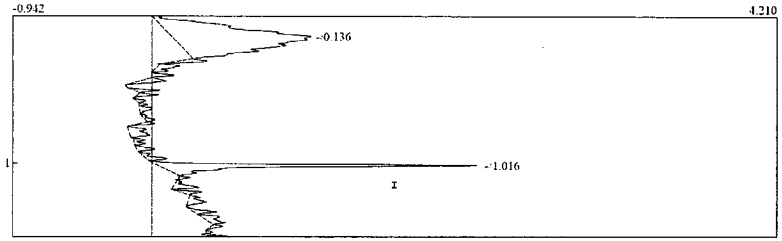
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 13:45:13
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 2 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 2 Injections 3 - 4

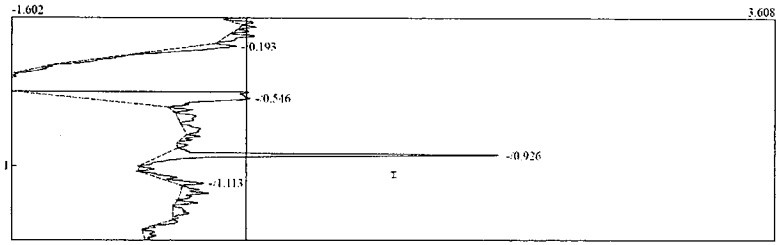
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:14:55
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 3 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

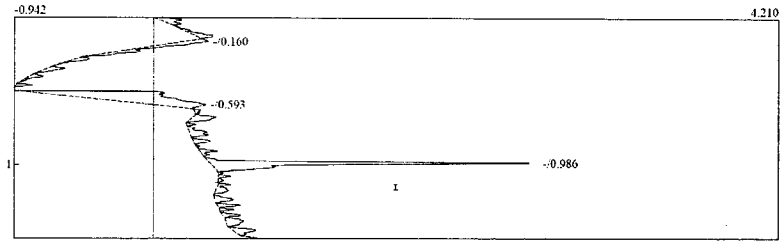
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:16:39
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 3 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 3 Injections 1 - 2

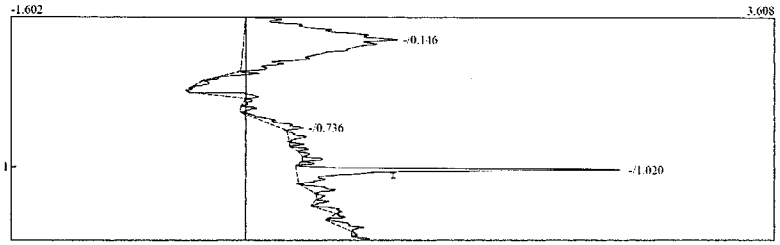
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:18:17
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 3 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

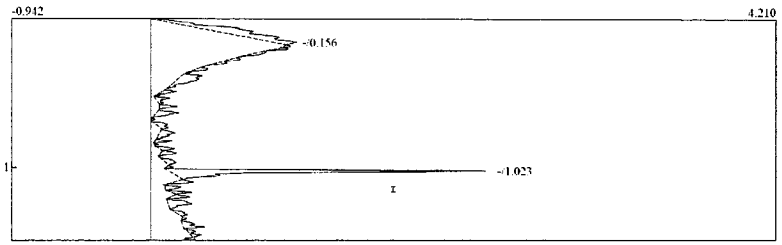
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:20:04
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 3 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 3 Injections 3 - 4

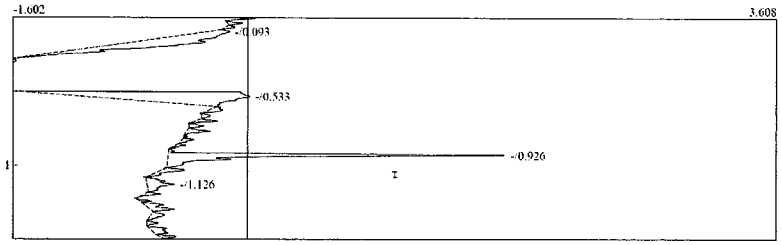
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:27:02
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 4 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

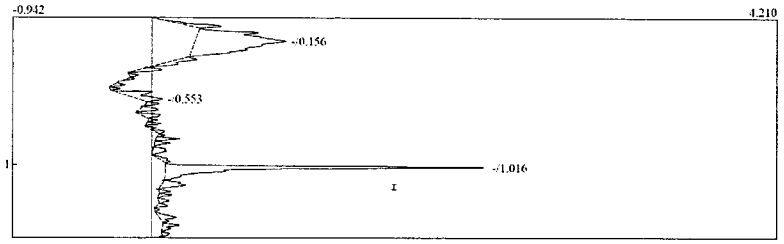
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:28:40
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 4 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 4 Injections 1 - 2

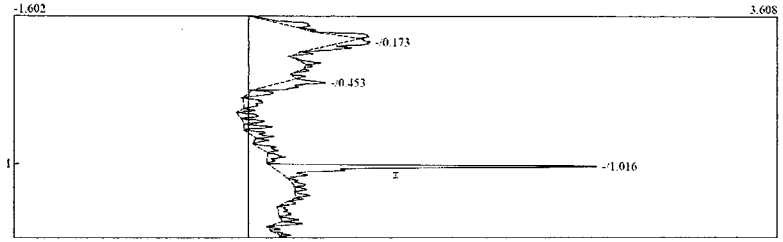
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:30:18
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 4 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

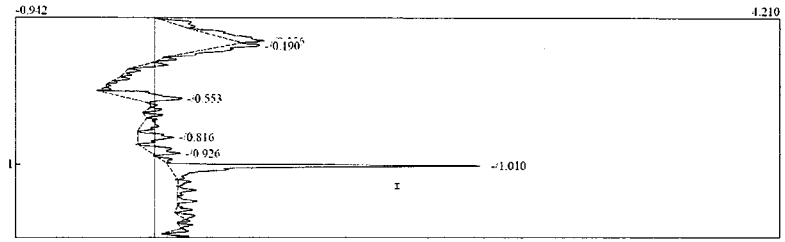
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:31:57
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 4 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 4 Injections 3 - 4

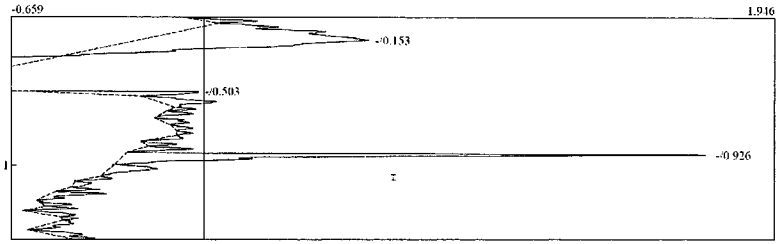
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:39:28
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 5 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

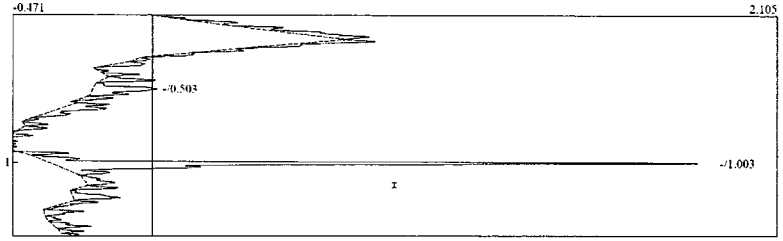
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:41:08
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 5 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 5 Injections 1 - 2

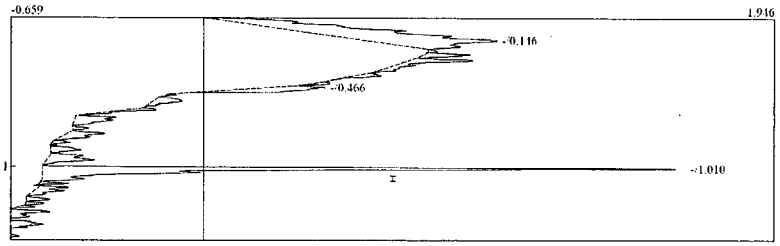
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:42:48
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 5 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

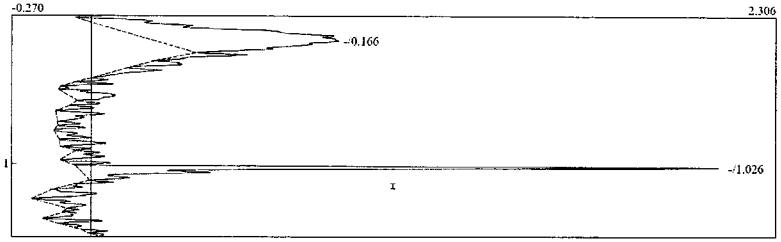
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:44:24
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 5 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 5 Injections 3 - 4

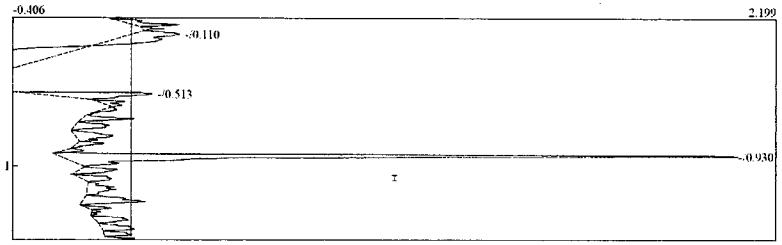
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:51:46
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 6 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

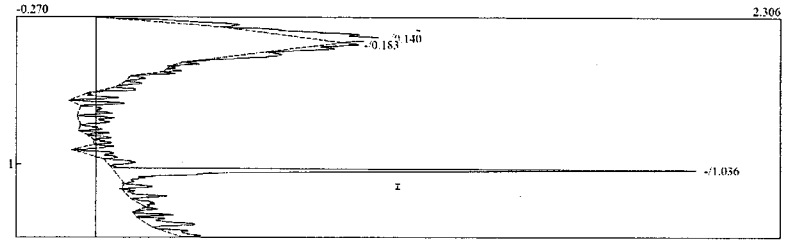
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:53:20
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 6 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 6 Injections 1 - 2

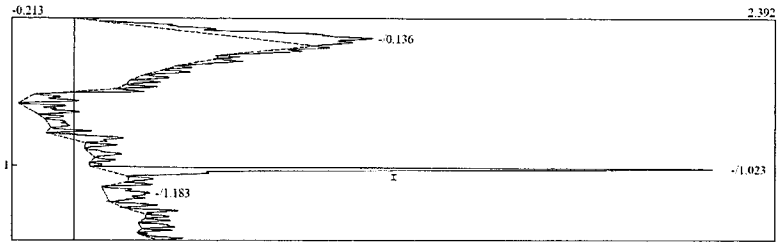
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:54:57
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 6 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

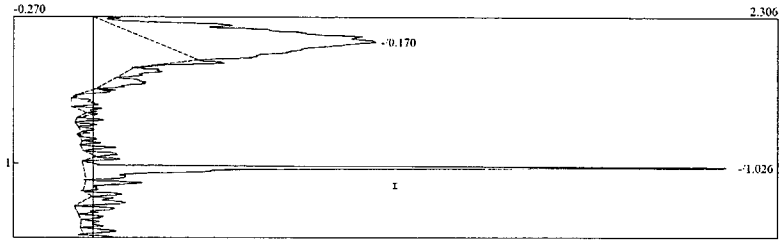
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 14:56:38
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 6 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 6 Injections 3 - 4

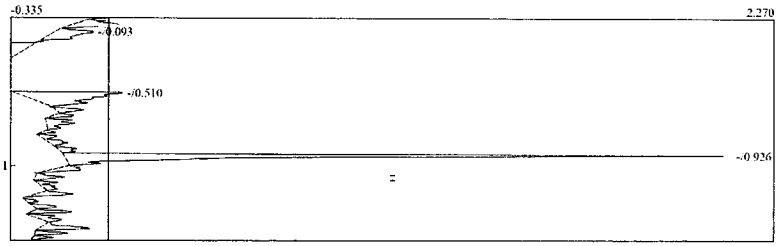
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:04:59
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 7 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

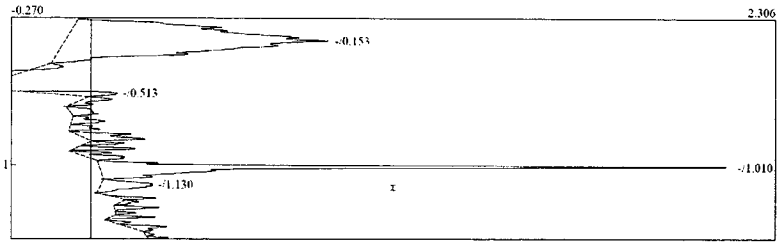
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:06:39
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 7 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 7 Injections 1 - 2

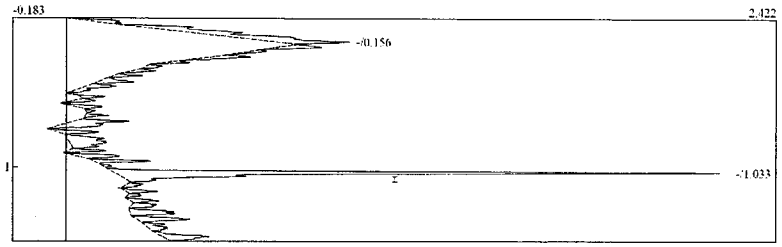
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:08:15
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 7 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

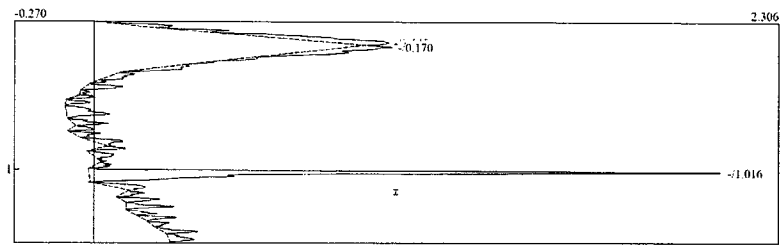
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:09:53
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 7 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 7 Injections 3 - 4

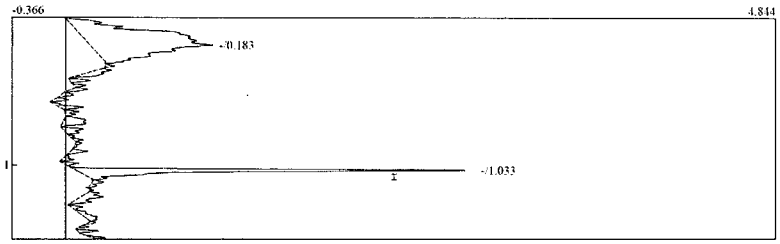
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:18:18
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 8 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

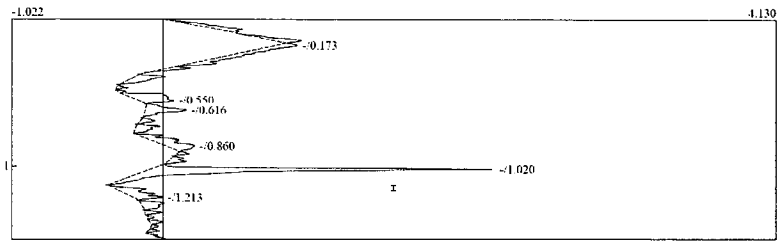
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:19:55
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 8 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 8 Injections 1 - 2

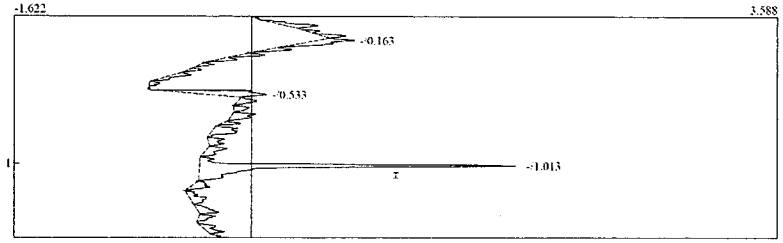
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:21:34
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 8 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

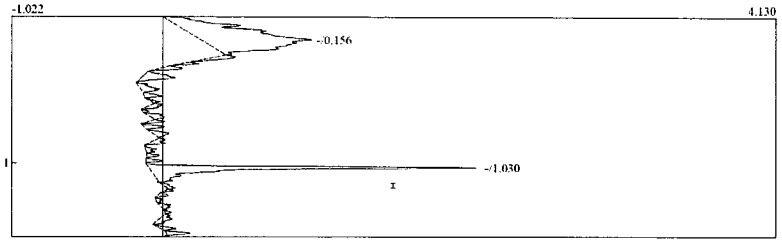
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:23:10
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 8 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 8 Injections 3 - 4

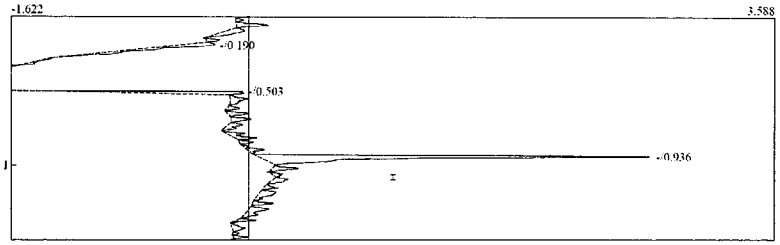
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:36:42
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 9 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

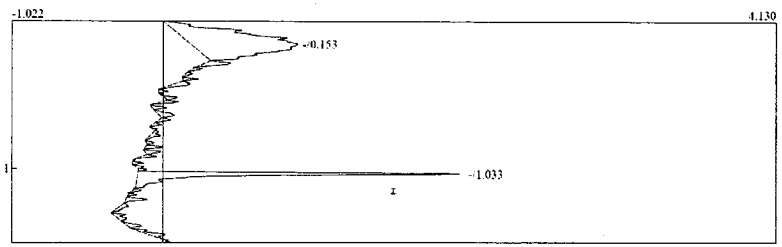
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:38:25
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 9 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 9 Injections 1 - 2

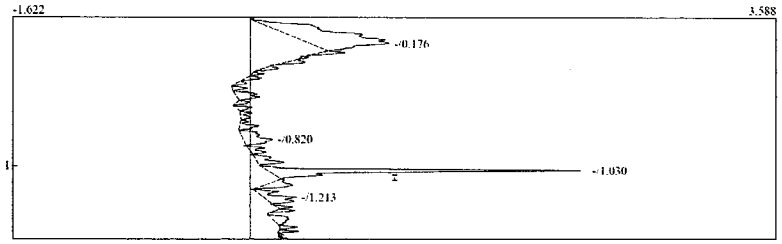
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:40:01
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 9 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

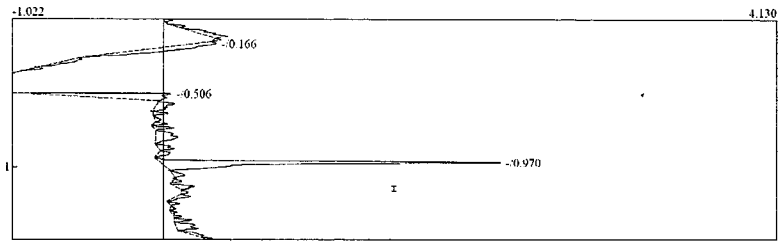
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:41:53
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 9 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 9 Injections 3 - 4

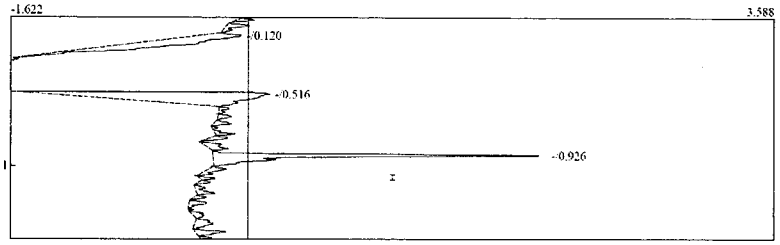
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:49:00
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 10 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

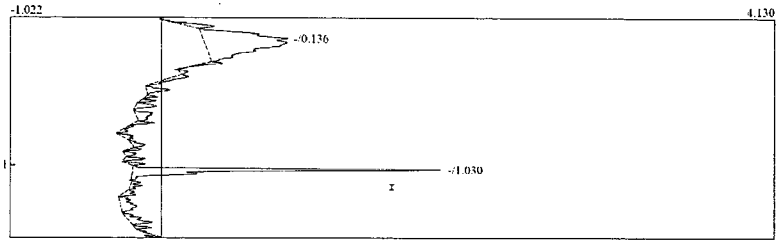
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:50:38
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 10 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 10 Injections 1 - 2

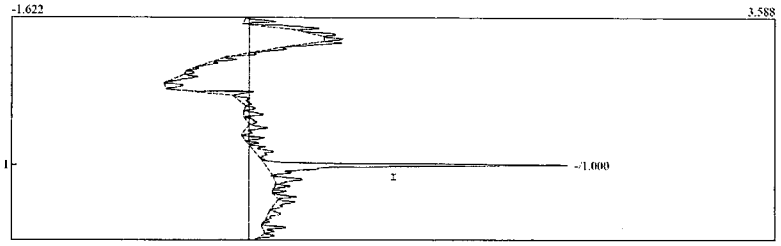
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:52:20
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 10 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

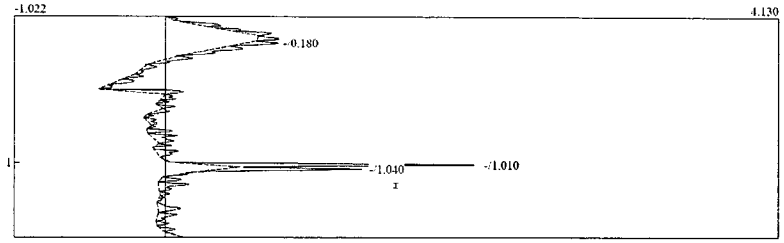
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:54:00
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 10 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 10 Injections 3 - 4

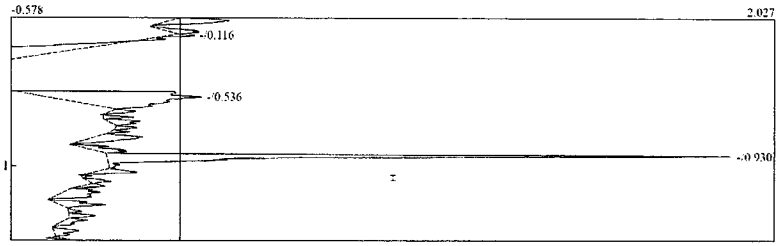
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:01:52
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 11 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

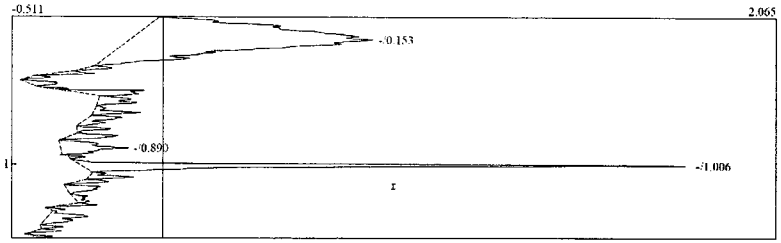
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:03:33
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 11 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 11 Injections 1 - 2

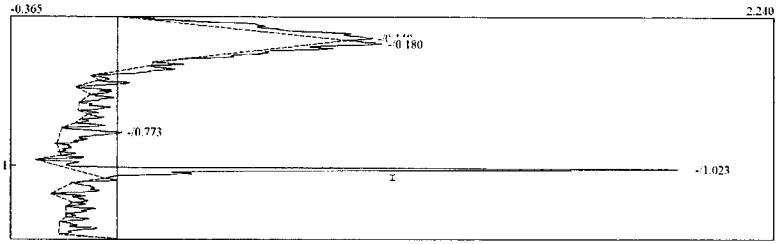
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:05:13
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 11 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

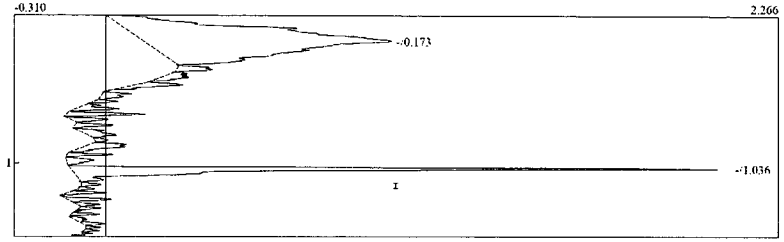
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:06:48
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 11 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 11 Injections 3 - 4

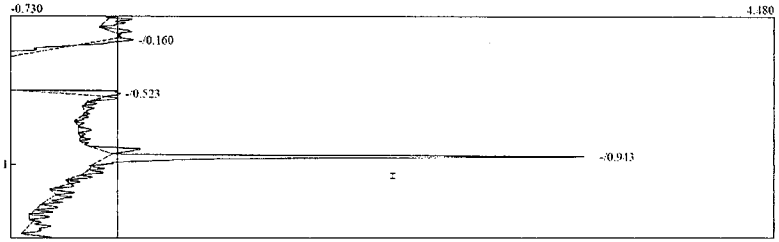
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:48:29
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 12 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

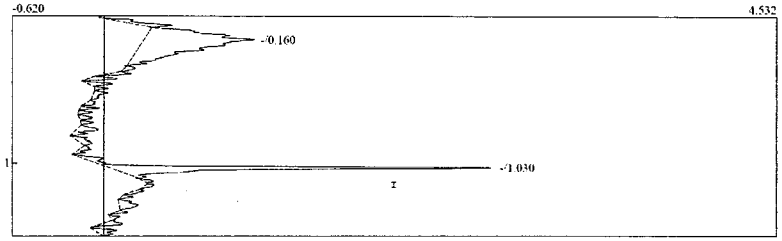
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:50:09
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 12 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 12 Injections 1 - 2

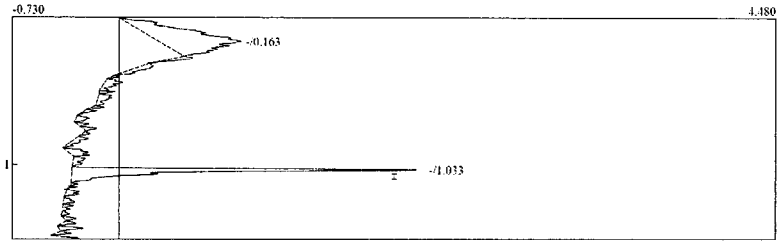
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:51:52
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 12 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

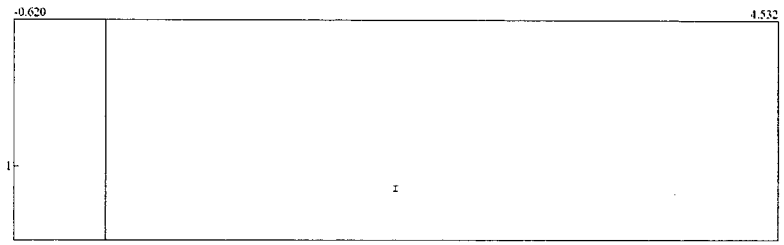
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 16:50:09
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 12 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 12 Injections 3 - 4

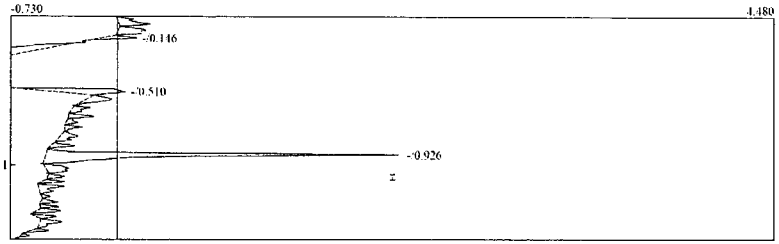
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:12:20
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 13 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

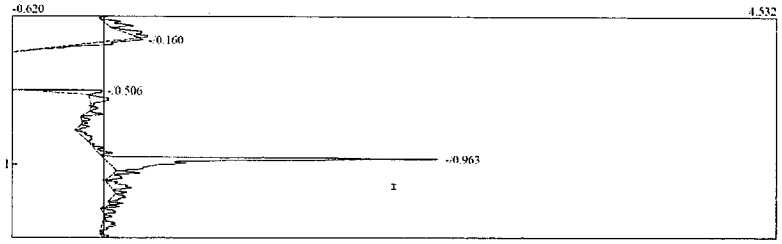
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:14:15
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 13 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 13 Injections 1 - 2

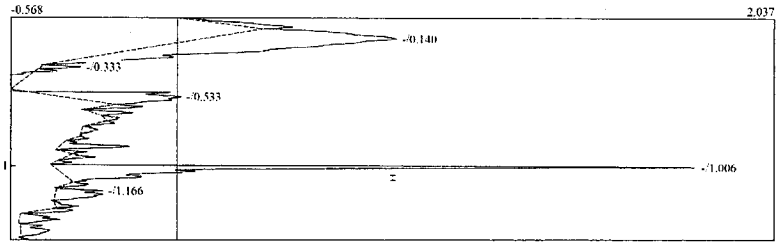
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:15:55
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 13 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

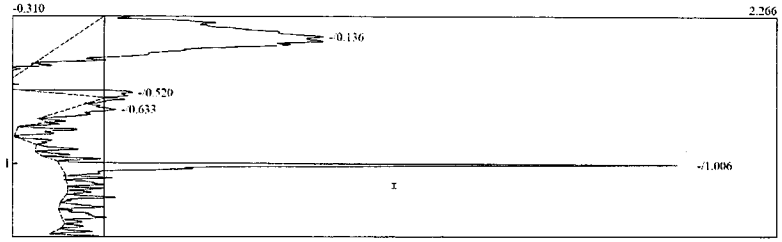
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:17:35
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 13 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 13 Injections 3 - 4

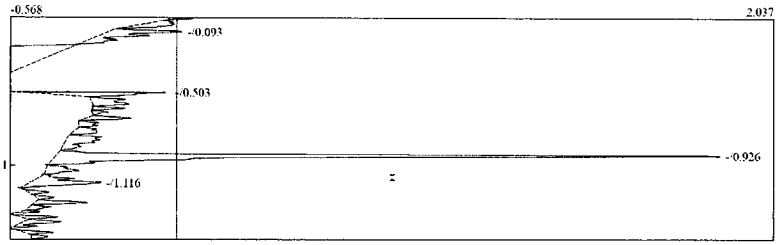
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:24:51
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 14 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

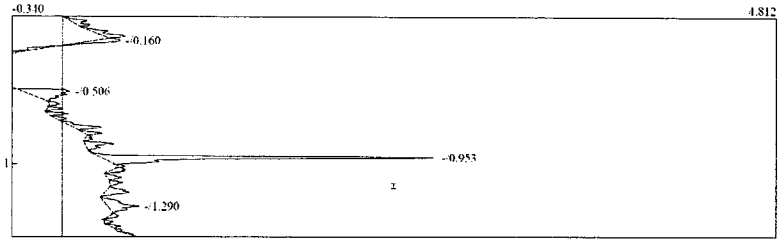
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:26:44
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 14 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 14 Injections 1 - 2

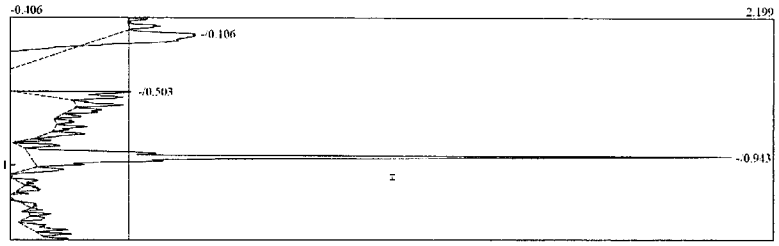
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:28:53
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 14 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

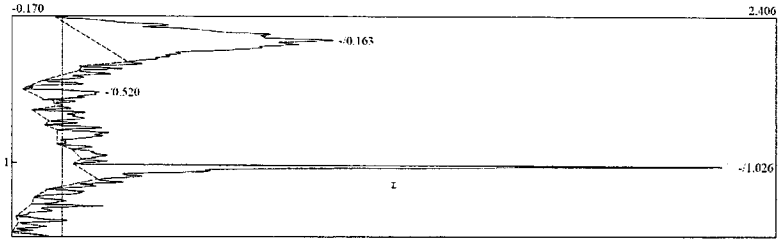
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:30:29
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 14 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 14 Injections 3 - 4

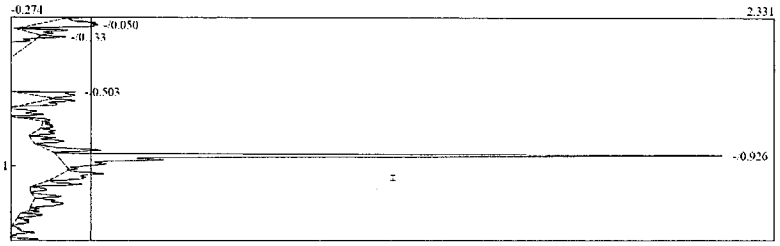
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:36:56
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 15 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

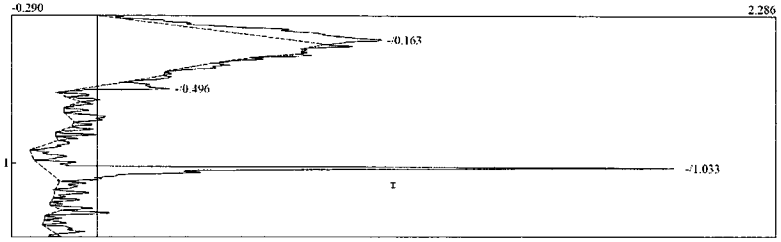
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:38:48
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 15 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 15 Injections 1 - 2

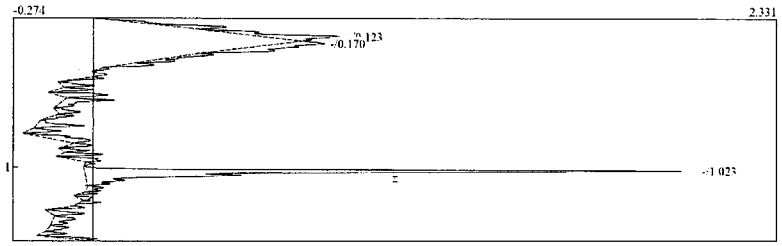
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:40:25
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 15 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

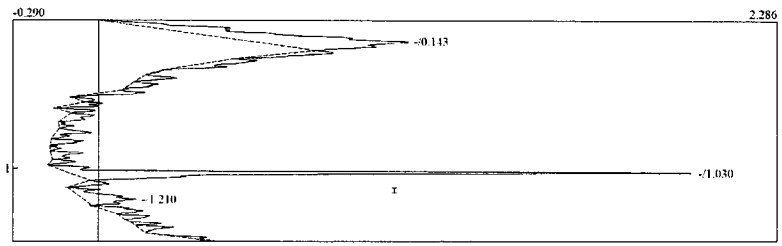
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 17:42:00
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 Quench 15 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 2 Quench 15 Injections 3 - 4

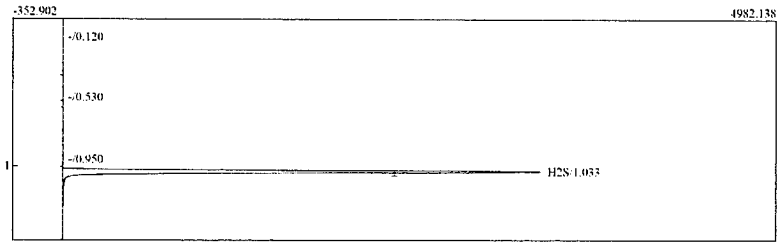
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/01/2016 15:32:27
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 High Cal Check 01
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	1.033	3825.1488	145.2123	ppm
		3825.1488	145.2123	

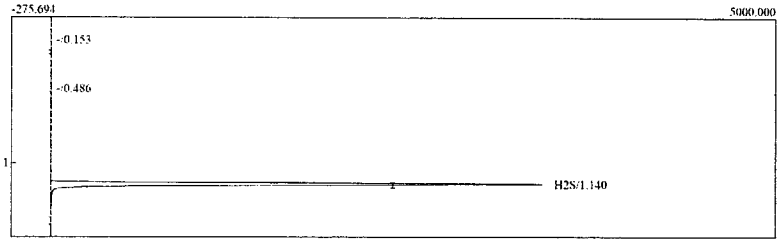
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 06:48:34
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 2 High Cal Check 02
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	1.140	3753.3274	143.8652	ppm
		3753.3274	143.8652	

Run 2 Quench Tower High Cal Check

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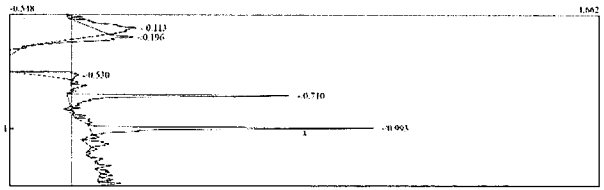
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:41:35
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 1 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
	0.0000	0.0000		

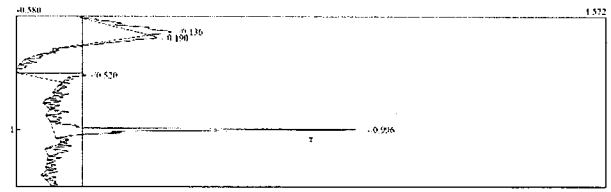
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:43:16
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 1 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
	0.0000	0.0000		

Run 3 Quench 1 Injections 1 - 2

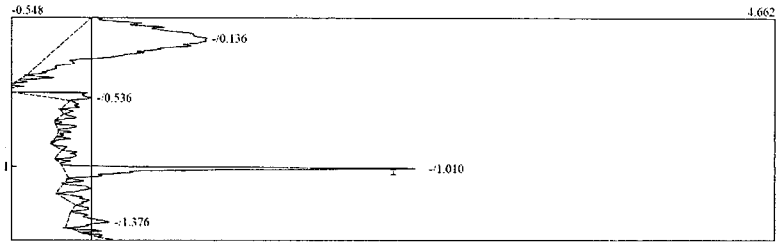
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:44:59
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 1 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

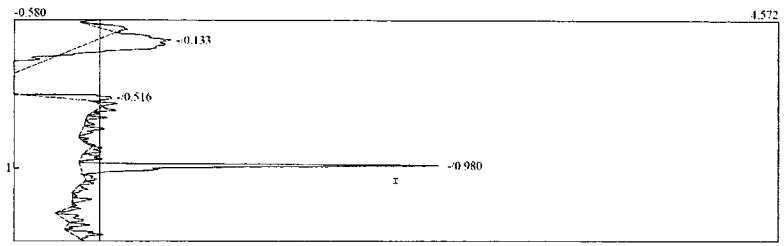
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:46:46
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 1 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 1 Injections 3 - 4

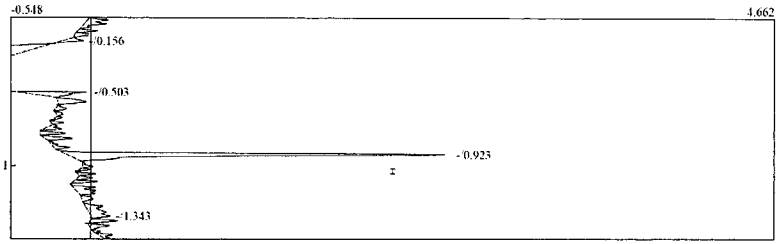
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:55:28
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 2 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

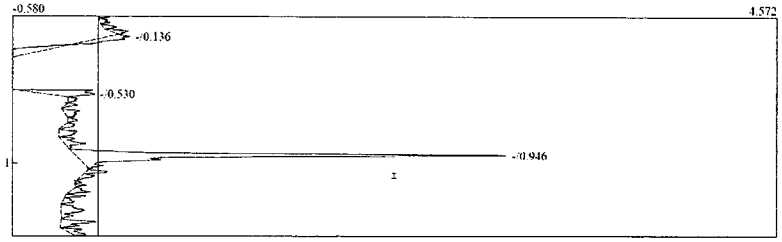
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:57:31
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 2 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 2 Injections 1 - 2

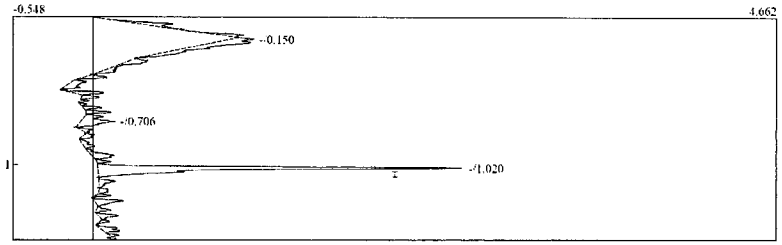
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:59:07
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 2 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

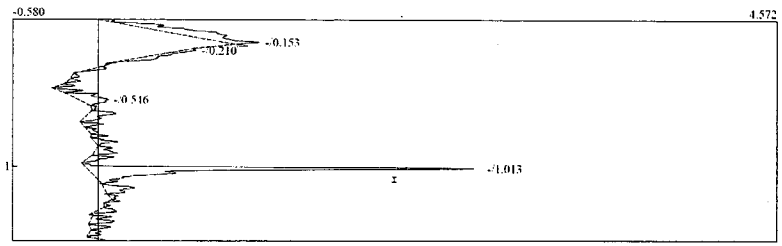
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:00:45
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 2 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 2 Injections 3 - 4

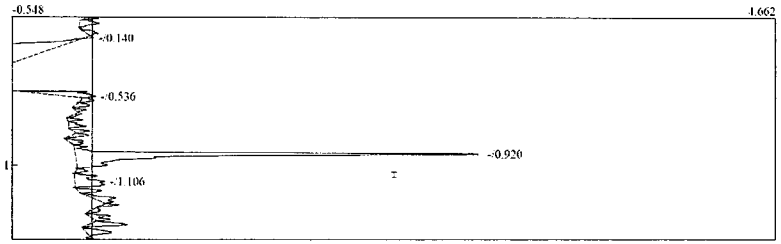
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:08:27
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 3 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

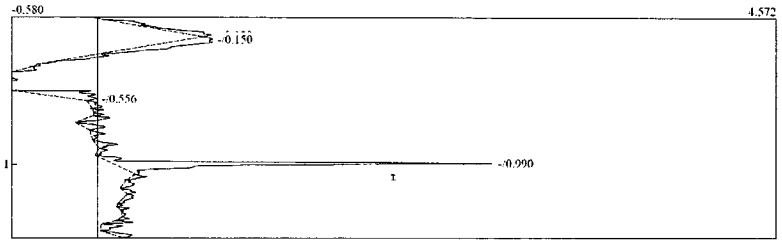
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:10:09
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 3 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 3 Injections 1 - 2

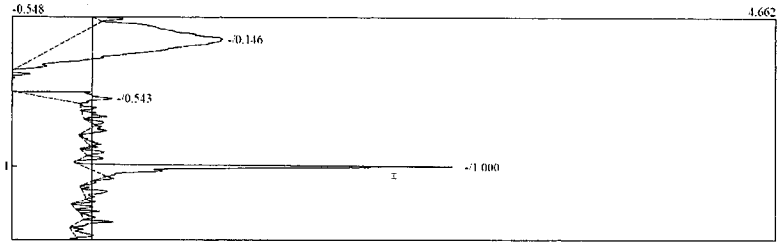
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:11:49
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 3 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

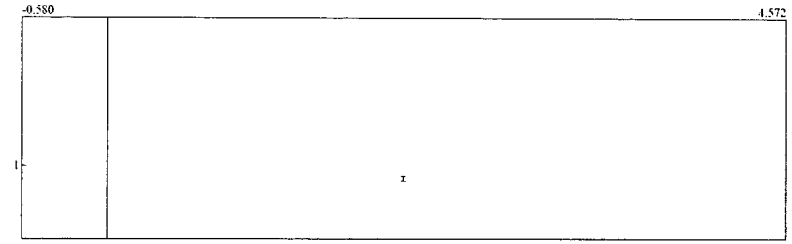
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:10:09
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 3 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 3 Injections 3 - 4

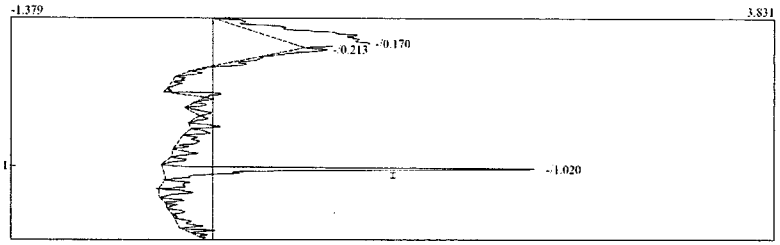
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:23:40
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 4 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

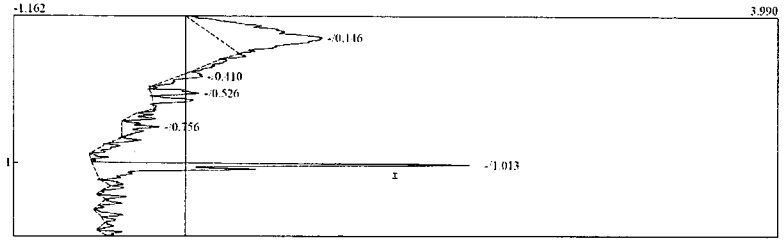
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:25:17
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 4 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 4 Injections 1 - 2

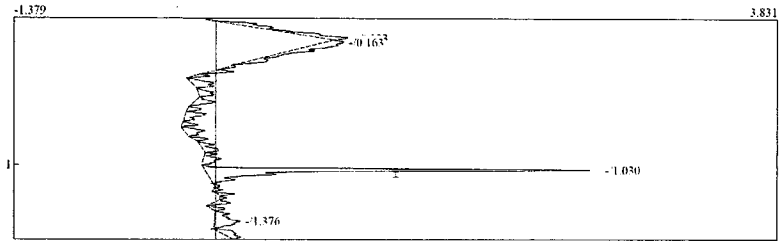
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:27:16
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 4 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

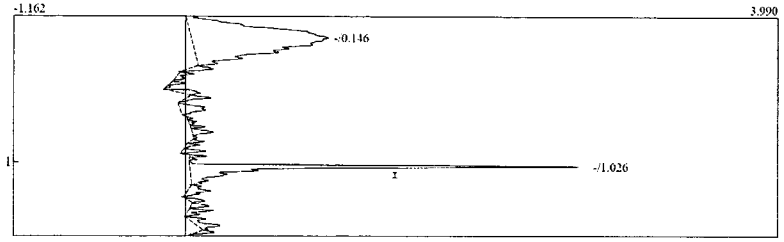
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 08:28:51
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 4 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 4 Injections 3 - 4

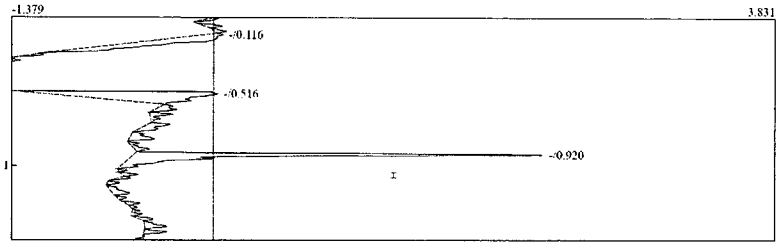
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:05:14
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 5 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

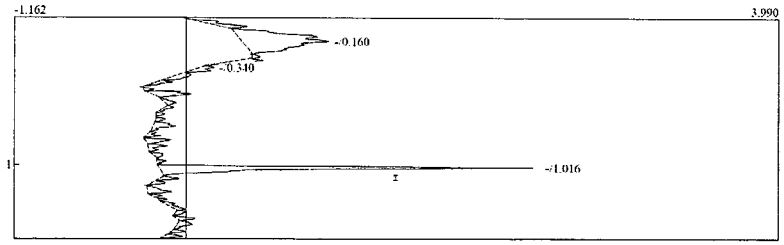
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:06:51
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 5 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 5 Injections 1 - 2

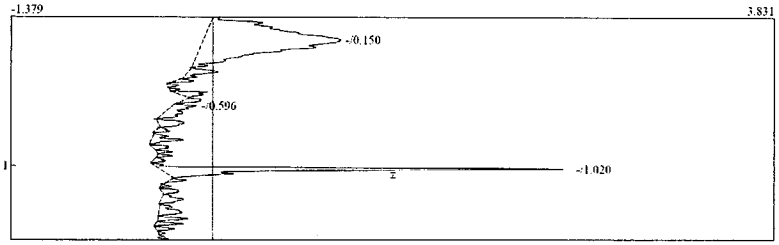
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:08:28
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 5 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

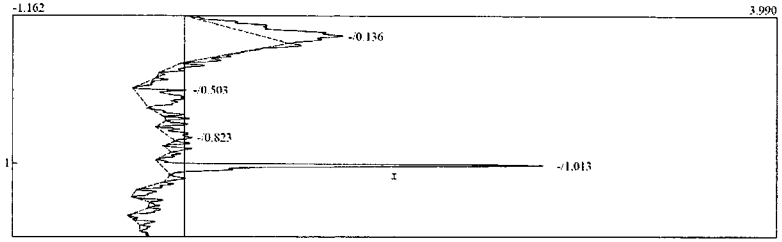
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:10:06
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 5 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 5 Injections 3 - 4

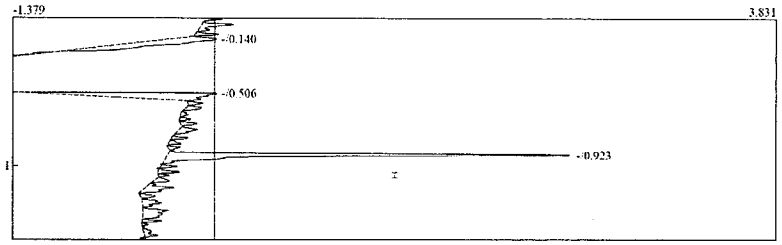
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:22:13
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 6 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

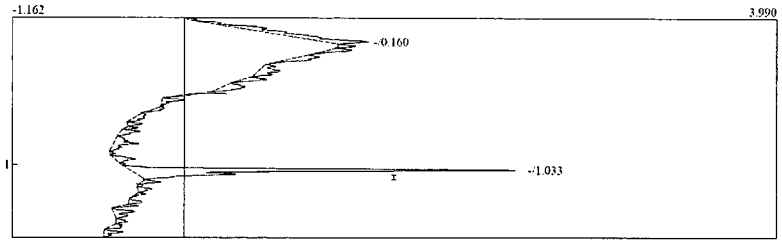
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:23:52
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 6 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 6 Injections 1 - 2

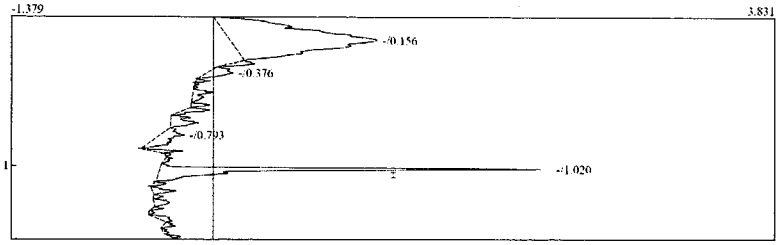
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:25:32
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 6 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

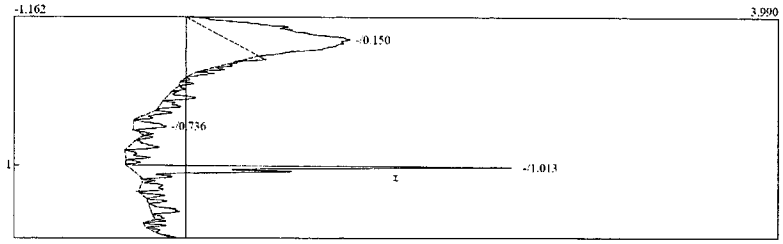
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:27:09
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 6 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 6 Injections 3 - 4

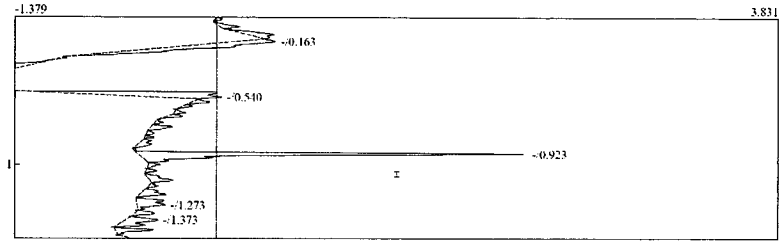
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:35:31
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 7 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

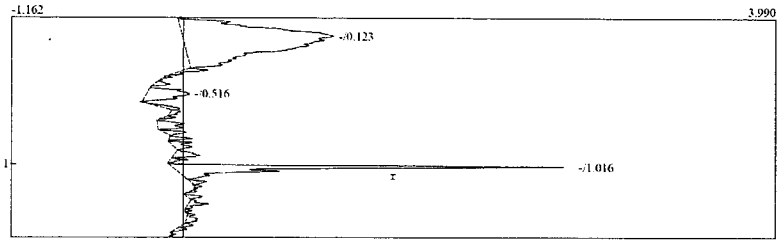
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:37:10
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 7 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 7 Injections 1 - 2

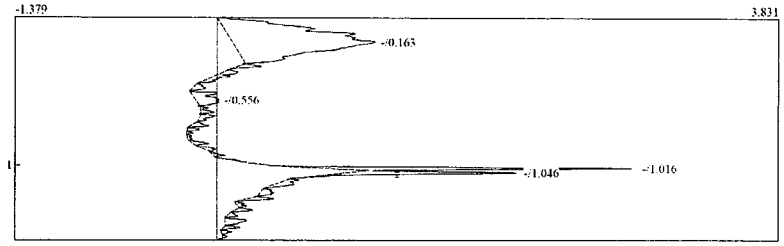
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:38:47
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 7 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

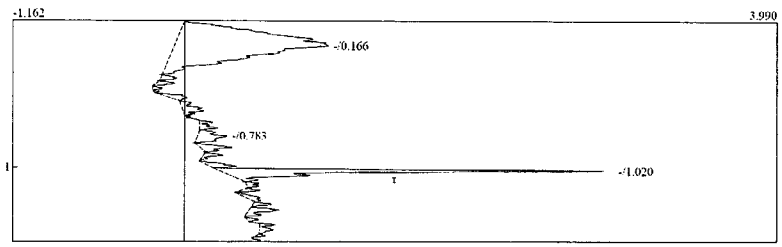
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:40:27
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 7 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 7 Injections 3 - 4

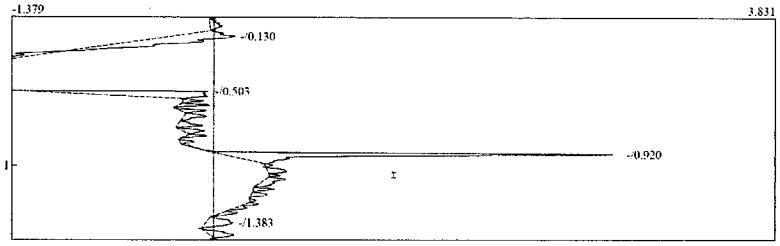
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:51:38
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 8 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

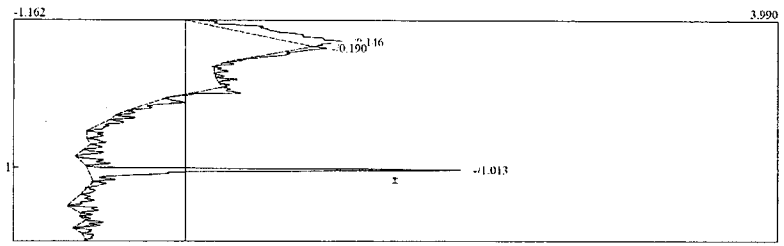
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:53:16
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 8 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 8 Injections 1 - 2

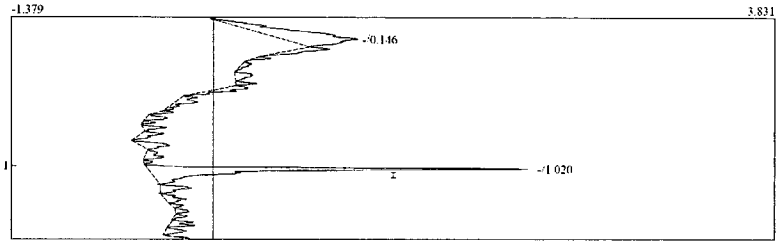
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:54:59
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 8 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

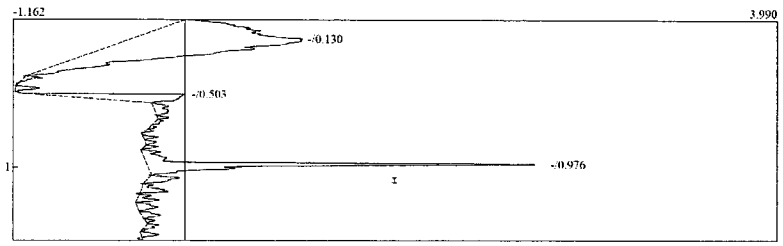
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 09:56:45
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 8 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 8 Injections 3 - 4

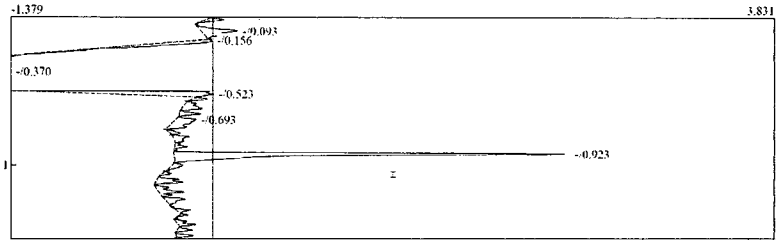
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:03:12
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 9 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

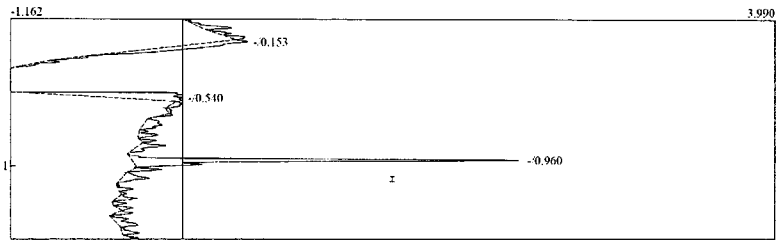
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:05:05
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 9 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 9 Injections 1 - 2

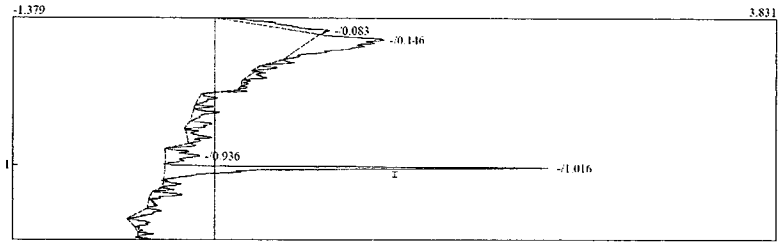
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:06:41
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 9 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

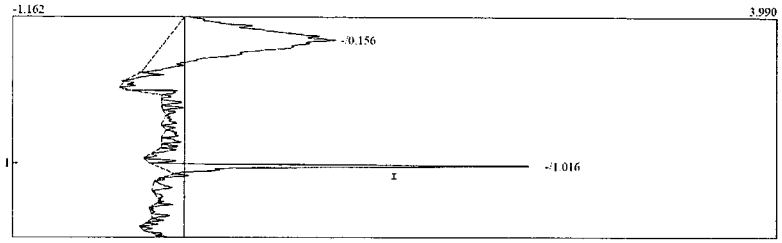
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:08:22
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 9 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 9 Injections 3 - 4

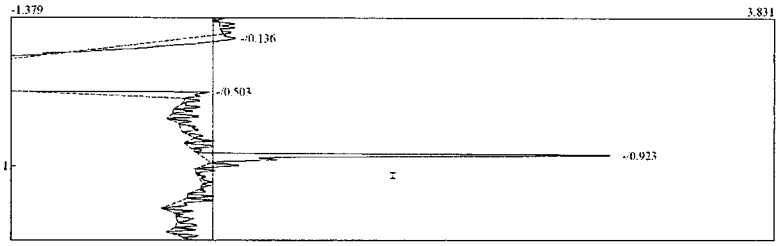
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:18:46
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 10 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

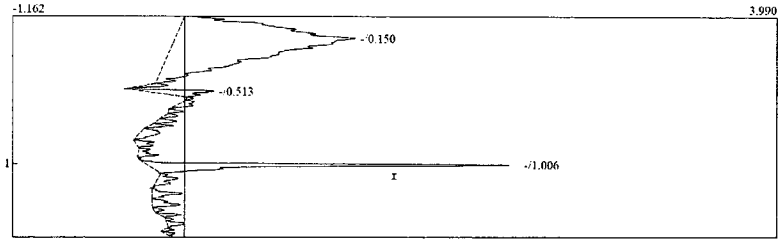
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:20:24
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 10 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 10 Injections 1 - 2

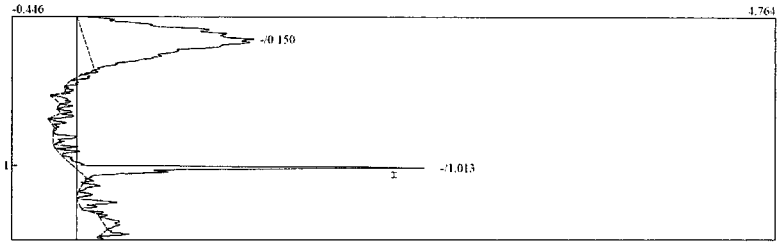
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:22:02
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 10 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

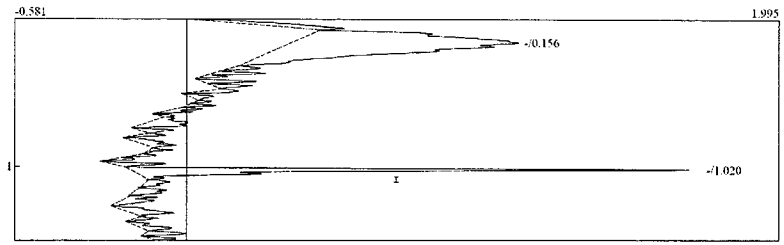
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:23:39
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 10 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 10 Injections 3 - 4

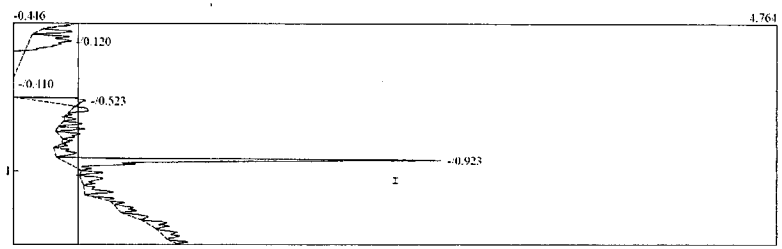
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:29:13
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 11 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

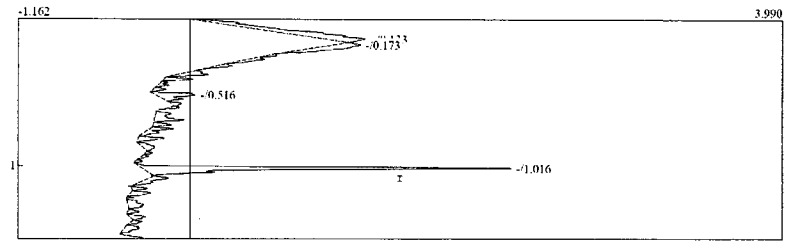
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:30:51
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 11 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 11 Injections 1 - 2

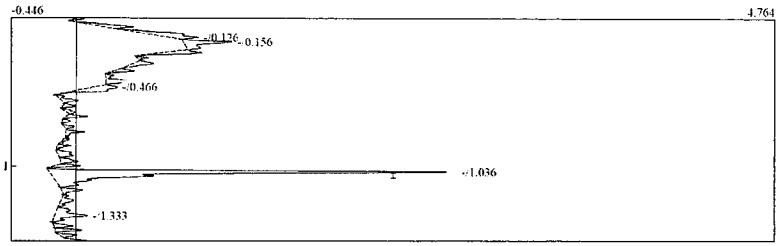
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:32:32
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 11 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

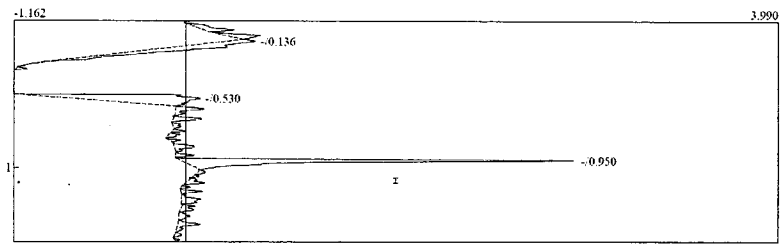
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:34:29
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 11 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 11 Injections 3 - 4

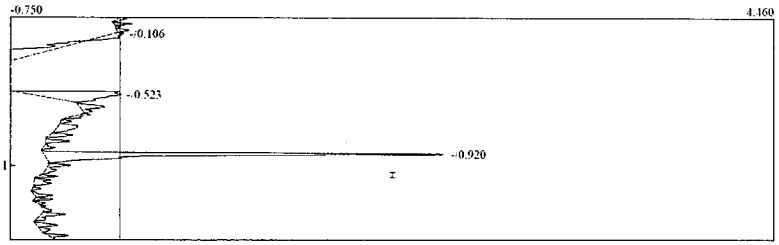
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:41:32
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 12 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

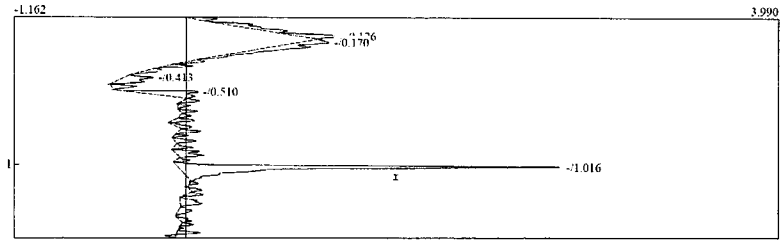
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:43:09
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 12 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 12 Injections 1 - 2

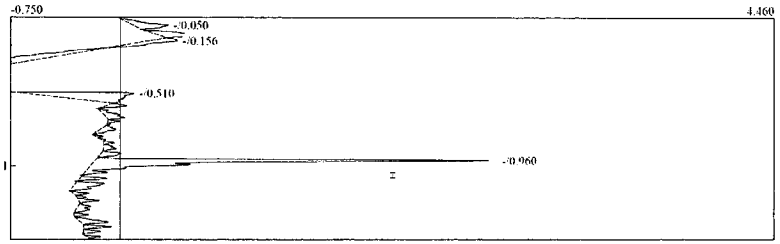
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:45:02
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 12 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

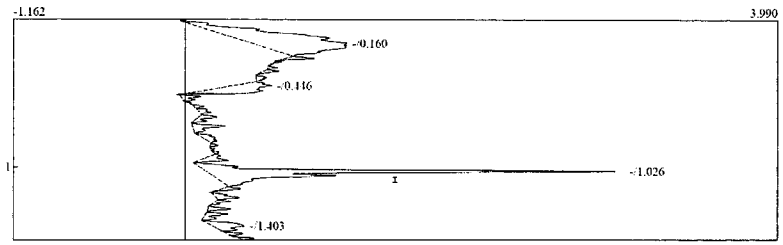
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:46:37
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 12 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 12 Injections 3 - 4

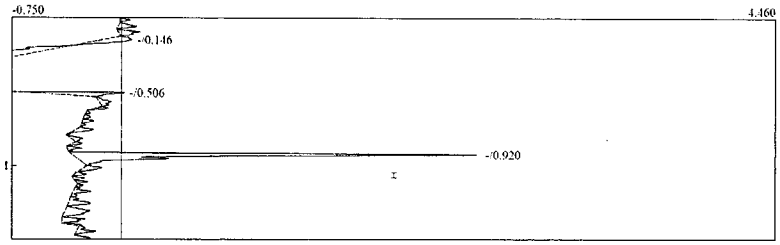
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:53:47
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 13 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

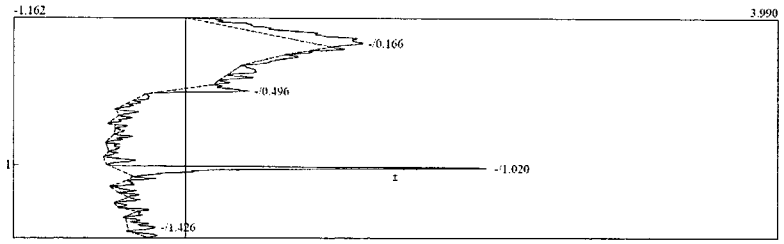
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:55:24
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 13 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 13 Injections 1 - 2

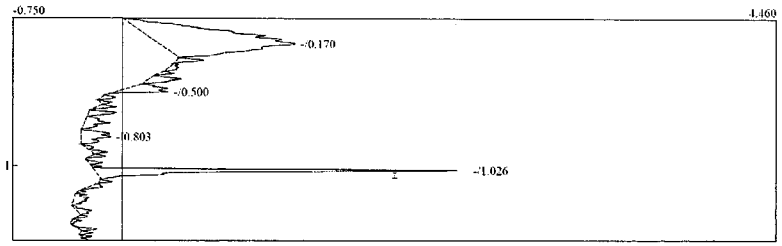
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:56:59
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 13 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

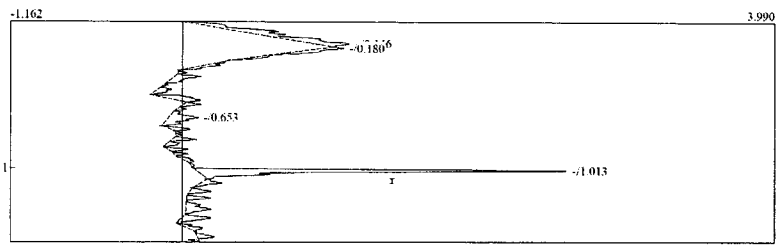
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 10:58:36
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 13 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 13 Injections 3 - 4

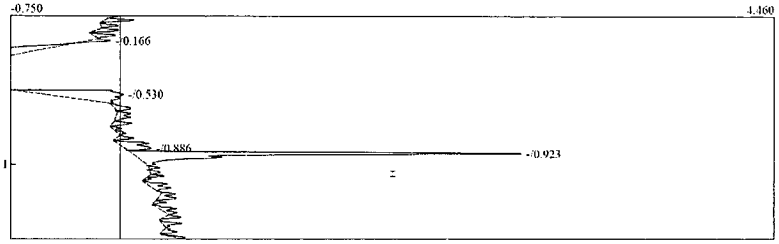
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 11:51:41
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 14 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

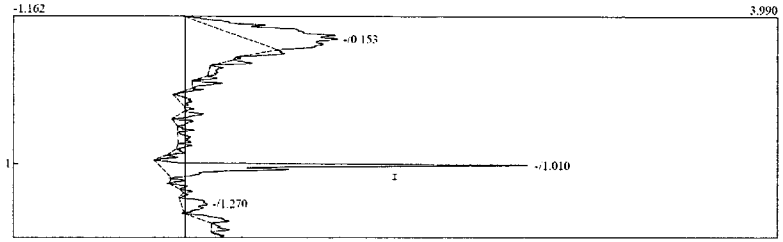
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 11:53:26
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 14 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 14 Injections 1 - 2

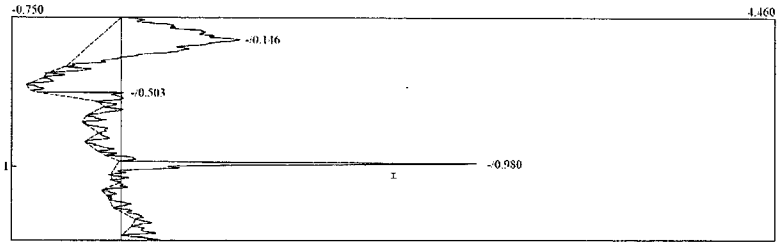
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 11:55:12
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 14 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

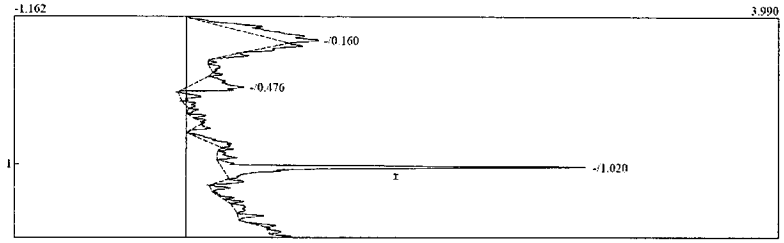
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 11:56:49
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 14 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 14 Injections 3 - 4

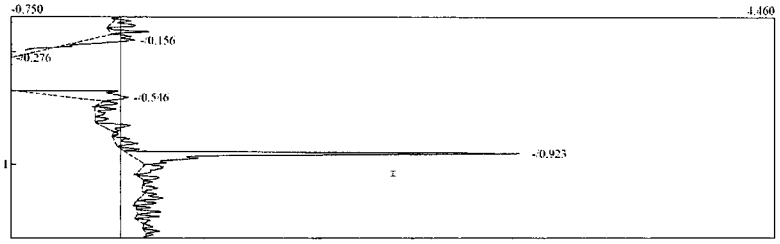
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:05:36
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 15 01

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

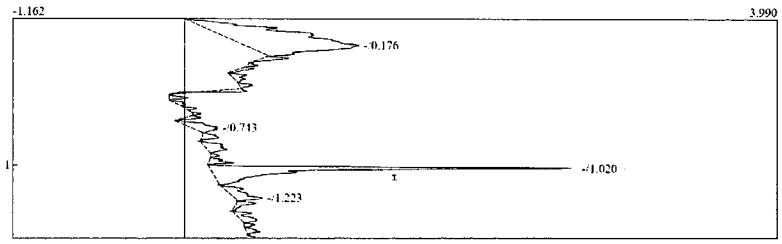
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:07:12
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 15 02

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 15 Injections 1 - 2

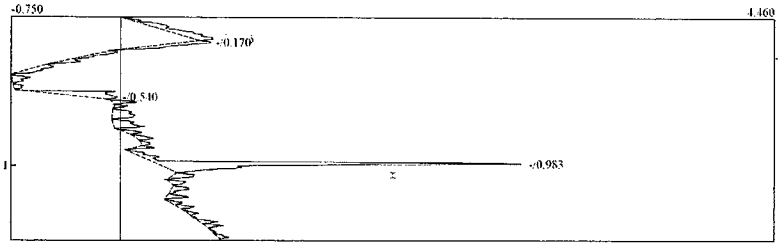
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:08:57
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 15 03

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

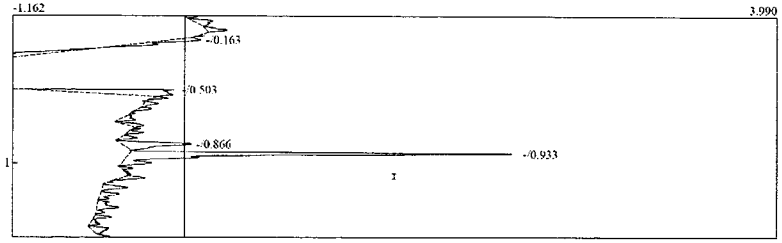
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 12:11:16
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Quench 15 04

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Run 3 Quench 15 Injections 3 - 4

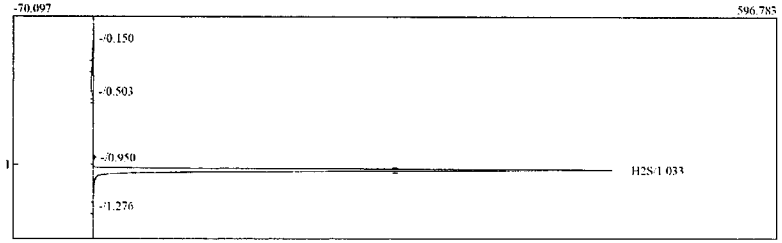
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:10:20
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Mid Cal Check 01
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	1.033	514.6166	56.2457	ppm
		514.6166	56.2457	

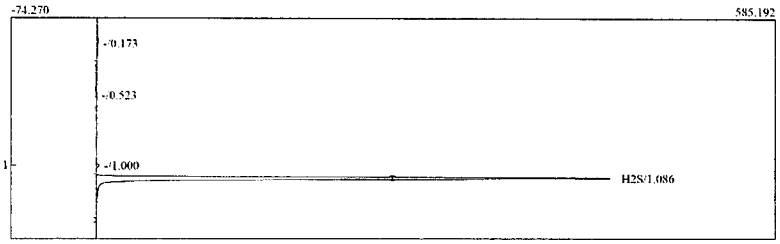
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 11/02/2016 07:12:00
Method: Rotary Valve Injection
Description: FPD-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Quench Tower Run 3 Mid Cal Check 02
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
150.00	1.500	0.000	150.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	1.086	506.3217	55.8223	ppm
		506.3217	55.8223	

Run 3 Quench Tower Mid Cal Check

APPENDIX E

Citrate Buffer Verification Files and Nomenclature

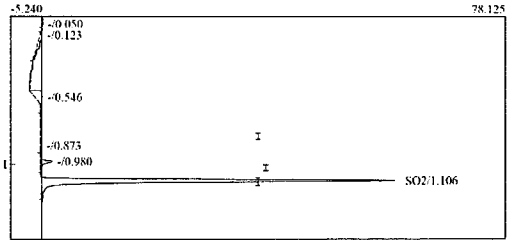
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/31/2016 16:02:40
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: SO2 Timecheck
Comments: SO2 - 25 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
SO2	1.106	75.8591
		75.8591

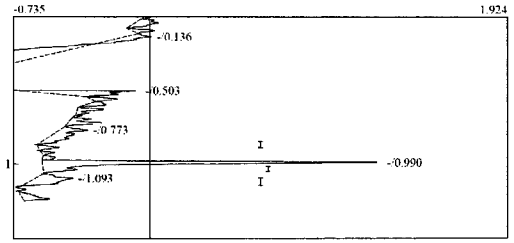
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/31/2016 16:07:12
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: SO2 Through Buffer
Comments: SO2 - 25 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

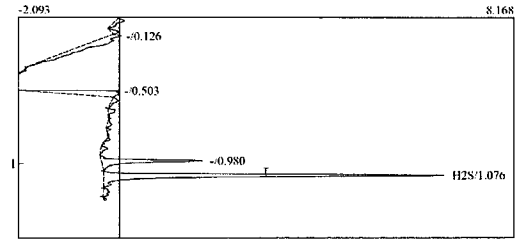
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/31/2016 15:53:51
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 60 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Low H2S Through Buffer
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.076	8.9127
		8.9127

Buffer Verification Chromatograms

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 C

Laboratory Data included on CD:

Water Samples for:

Cyanides
Fluorides and Chlorides
Sulfides
Total Dissolved Solids
Selected Volatile Organic Compounds
PCDD-PCDF's
PAHs and Selected Semi-Volatile Organic Compounds
Total Metals

Pollutant Type	Run Number	Results	Run Averages	Notes
Cyanide, Total (µg/mL)	1A	< 1.7	< 2.93	
	1B	2.2		
	1C	4.9		
	2A	< 1.7	< 1.73	
	2B	< 1.7		
	2C	1.8		
	3A	2.5	2.4	
	3B	2.2		
	3C	2.5		
Chloride (mg/L) *	1A	31.4	31.3	
	1B	31.4		
	1C	31		
	2A	30.9	30.8	
	2B	30.9		
	2C	30.5		
Fluoride (mg/L) *	1A	1.87	1.8	
	1B	1.81		
	1C	1.79		
	2A	1.76	1.8	
	2B	1.76		
	2C	1.78		
Sulfides (mg/L)	1A	2.0	1.6	J
	1B	1.1		J
	1C	1.8		J
	2A	1.5	1.6	J
	2B	1.8		J
	2C	1.4		J
	3A	1.2	1.1	J
	3B	1.1		J
	3C	0.92		J
Total Dissolved Solids (mg/L) *	1A	460	467	
	1B	460		
	1C	480		
	2A	460	467	
	2B	480		
	2C	460		

* Samples 3A, 3B, and 3C were not collected and analyzed

J = Estimated results. Results is less than Reporting Limit

Pollutant Type	Run Number	Parameter		Results	Total	Notes
Total Metals (µg/L)	1A	Antimony		18.3	391	B
		Arsenic		233		
		Beryllium		1.6		B
		Cadmium	<	0.51		
		Chromium		10		B
		Cobalt		5.9		B
		Lead		7.3		B
		Manganese		79.2		J
		Nickel		14.5		B
		Selenium		20.2		
	1B	Antimony		17.7	386	B
		Arsenic		232		
		Beryllium		1.6		B
		Cadmium	<	0.51		
		Chromium		9.2		B
		Cobalt		5.6		B
		Lead		7.4		B
		Manganese		79.3		J
		Nickel		13.9		B
		Selenium		18.8		
	1C	Antimony		15.9	373	B
		Arsenic		231		
		Beryllium		1.4		B
		Cadmium	<	0.51		
		Chromium		8.5		B
		Cobalt		5		B
		Lead		8.3		B
		Manganese		68.1		J
		Nickel		12.6		B
		Selenium		21.3		
	2A	Antimony		18	366	B
		Arsenic		230		
		Beryllium		1.4		B
		Cadmium	<	0.51		
		Chromium		8.3		B
		Cobalt		4.8		B
		Lead		6.2		B
		Manganese		63.9		J
		Nickel		12.9		B
		Selenium		19.6		
	2B	Antimony		17.9	368	B
		Arsenic		230		
		Beryllium		1.5		B
		Cadmium	<	0.51		
		Chromium		8.7		B
		Cobalt		5		B
		Lead		6.8		B
		Manganese		68.3		J
		Nickel		12.5		B
		Selenium		17.2		
	2C	Antimony		18.1	370	B
		Arsenic		230		
		Beryllium		1.5		B
		Cadmium	<	0.51		
		Chromium		9		B
		Cobalt		5.1		B
		Lead		6.6		B
		Manganese		67.7		J
		Nickel		12.8		B
		Selenium		19.1		
	3A	Antimony		16.8	355	B
		Arsenic		226		
		Beryllium		1.3		B
		Cadmium	<	0.51		
		Chromium		7.6		B
		Cobalt		4.6		B
		Lead		6.2		B
		Manganese		62.5		J
		Nickel		11.7		B
		Selenium		18.2		
	3B	Antimony		16.4	352	B
		Arsenic		224		
		Beryllium		1.3		B
		Cadmium	<	0.51		
		Chromium		7.9		B
		Cobalt		4.5		B
		Lead		6.6		B
		Manganese		61.2		J
		Nickel		11.2		B
		Selenium		18.8		
	3C	Antimony		18.6	353	B
		Arsenic		227		
		Beryllium		1.3		B
		Cadmium	<	0.51		
		Chromium		7.8		B
		Cobalt		4.7		B
		Lead		4.1		B
		Manganese		61.5		J
		Nickel		11.7		B
		Selenium		15.9		

J = The associated method blank contains the target analyte at a reportable level
B = Estimated result. Result is less than the Reporting Limit.

Pollutant Type	Run Number	Parameter	Results		Notes
	1A	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.32	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide		0.23	J
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		0.5	J
		Iodomethane	<	5	
		Methylene Chloride		1.4	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.26	
		Toluene		2700	D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)	<	1	
	1B	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.32	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide	<	0.2	J
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		0.47	J
		Iodomethane	<	5	
		Methylene Chloride		1.1	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.26	
		Toluene		2300	B
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)	<	1	
	1C	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene	<	0.54	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide		0.57	J
		Carbon tetrachloride	<	0.27	
		Chlorobenzene		0.25	J
		Chloroethane	<	0.65	
		Chloroform		0.19	J
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		0.97	J
		Iodomethane	<	5	
		Methylene Chloride		1.4	J, B
		Styrene		0.2	J
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene		0.28	J
		Toluene		4900	D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)		1.2	J

Pollutant Type	Run Number	Parameter	Results		Notes
VOCs (µg/L)	2A	1, 1-Dichloroethene		0.34	J
		Acrylonitrile	<	7	
		Benzene		0.97	J, B
		Bromoform	<	2.5	
		Bromomethane		1.4	J
		Carbon disulfide		0.76	J
		Carbon tetrachloride	<	0.27	
		Chlorobenzene		0.6	J
		Chloroethane		0.74	J
		Chloroform		0.58	J
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane		0.43	J
		Ethylbenzene		1.7	J
		Iodomethane	<	5	
		Methylene Chloride		2.1	J, B
		Styrene		0.45	J
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene		0.6	J
		Toluene		4000	D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene		0.53	J
		Vinyl chloride	<	2	
		Xylenes (total)		2.0	J
	2B	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.28	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide	<	0.2	
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		1.1	J
		Iodomethane	<	5	
		Methylene Chloride		1.2	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.26	
		Toluene		5900	D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)	<	1	
	2C	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.38	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide	<	0.2	
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		0.87	J
		Iodomethane	<	5	
		Methylene Chloride		1.5	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.26	
		Toluene		5400	B, D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)	<	1	

Pollutant Type	Run Number	Parameter	Results		Notes
	3A	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.39	J
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide	<	0.2	
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		1.2	J, B
		Iodomethane	<	5	
		Methylene Chloride		1.6	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.26	
		Toluene		1200	B, E
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)	<	1	
	3B	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.36	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide	<	0.2	
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		1.1	J
		Iodomethane	<	5	
		Methylene Chloride		1.0	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.26	
		Toluene		6200	B, D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)		1.1	J
	3C	1, 1-Dichloroethene	<	0.33	
		Acrylonitrile	<	7	
		Benzene		0.36	J, B
		Bromoform	<	2.5	
		Bromomethane	<	0.7	
		Carbon disulfide	<	0.2	
		Carbon tetrachloride	<	0.27	
		Chlorobenzene	<	0.2	
		Chloroethane	<	0.65	
		Chloroform	<	0.18	
		Chloromethane	<	2	
		1, 2-Dichloroethane	<	1	
		1, 2-Dichloropropane	<	0.24	
		Ethylbenzene		1.3	J
		Iodomethane	<	5	
		Methylene Chloride		1.3	J, B
		Styrene	<	0.2	
		1,1,2,2-Tetrachloroethane	<	0.41	
		Tetrachloroethene	<	0.28	
		Toluene		7100	B, D
		1,1,1-Trichloroethane	<	0.35	
		1,1,2-Trichloroethane	<	0.4	
		Trichloroethene	<	0.27	
		Vinyl chloride	<	2	
		Xylenes (total)		1.2	J

Pollutant Type	Run Number	Parameter	Results		Notes
	1A	2,3,7,8-TCDD	<	1.7	
		1,2,3,7,8-PeCDD	<	1.1	
		1,2,3,4,7,8-HxCDD		6.7	Q, J
		1,2,3,6,7,8HxCDD		33	Q, J
		1,2,3,7,8,9-HxCDD		58	Q, J
		1,2,3,4,6,7,8-HpCDD		1200	
		2,3,7,8-TCDF	<	1.1	
		1,2,3,7,8-PeCDF	<	0.87	
		2,3,4,7,8-PeCDF	<	0.76	
		1,2,3,4,7,8-HxCDF	<	0.59	
		1,2,3,6,7,8-HxCDF	<	0.6	
		2,3,4,6,7,8-HxCDF	<	0.59	
		1,2,3,7,8,9-HxCDF	<	0.78	
		1,2,3,4,6,7,8-HpCDF		19	J
		1,2,3,4,7,8,9-HpCDF		3.9	Q, J
	1B	2,3,7,8-TCDD	<	1.3	
		1,2,3,7,8-PeCDD	<	1.2	
		1,2,3,4,7,8-HxCDD		7.4	Q, J
		1,2,3,6,7,8HxCDD		42	J
		1,2,3,7,8,9-HxCDD		64	J
		1,2,3,4,6,7,8-HpCDD		1400	
		2,3,7,8-TCDF	<	1	
		1,2,3,7,8-PeCDF	<	0.83	
		2,3,4,7,8-PeCDF	<	0.78	
		1,2,3,4,7,8-HxCDF	<	0.54	
		1,2,3,6,7,8-HxCDF	<	0.59	
		2,3,4,6,7,8-HxCDF	<	0.56	
		1,2,3,7,8,9-HxCDF	<	0.71	
		1,2,3,4,6,7,8-HpCDF		21	J
		1,2,3,4,7,8,9-HpCDF	<	1.6	
	1C	2,3,7,8-TCDD	<	1.3	
		1,2,3,7,8-PeCDD	<	0.99	
		1,2,3,4,7,8-HxCDD		6.8	J
		1,2,3,6,7,8HxCDD		32	J
		1,2,3,7,8,9-HxCDD		45	Q, J
		1,2,3,4,6,7,8-HpCDD		1100	
		2,3,7,8-TCDF	<	0.77	
		1,2,3,7,8-PeCDF	<	0.71	
		2,3,4,7,8-PeCDF	<	0.69	
		1,2,3,4,7,8-HxCDF	<	0.51	
		1,2,3,6,7,8-HxCDF	<	0.51	
		2,3,4,6,7,8-HxCDF	<	0.52	
		1,2,3,7,8,9-HxCDF	<	0.66	
		1,2,3,4,6,7,8-HpCDF		19	J
		1,2,3,4,7,8,9-HpCDF	<	1.4	
	2A	2,3,7,8-TCDD	<	1.5	
		1,2,3,7,8-PeCDD	<	1	
		1,2,3,4,7,8-HxCDD		8.2	Q, J
		1,2,3,6,7,8HxCDD		41	J
		1,2,3,7,8,9-HxCDD		62	J
		1,2,3,4,6,7,8-HpCDD		1400	
		2,3,7,8-TCDF	<	0.92	
		1,2,3,7,8-PeCDF	<	0.8	
		2,3,4,7,8-PeCDF	<	0.73	
		1,2,3,4,7,8-HxCDF	<	0.56	
		1,2,3,6,7,8-HxCDF	<	0.55	
		2,3,4,6,7,8-HxCDF	<	0.55	
		1,2,3,7,8,9-HxCDF	<	0.69	
		1,2,3,4,6,7,8-HpCDF		19	J
		1,2,3,4,7,8,9-HpCDF	<	1.9	

Pollutant Type	Run Number	Parameter	Results		Notes
PCDD-PCDF (pg/L)	2B	2,3,7,8-TCDD	<	2.8	
		1,2,3,7,8-PeCDD	<	1.8	
		1,2,3,4,7,8-HxCDD		10	Q, J
		1,2,3,6,7,8HxCDD		59	Q, J
		1,2,3,7,8,9-HxCDD		86	
		1,2,3,4,6,7,8-HpCDD		2000	
		2,3,7,8-TCDF	<	1.7	
		1,2,3,7,8-PeCDF	<	1.4	
		2,3,4,7,8-PeCDF	<	1.3	
		1,2,3,4,7,8-HxCDF	<	1	
		1,2,3,6,7,8-HxCDF	<	1	
		2,3,4,6,7,8-HxCDF	<	1.1	
		1,2,3,7,8,9-HxCDF	<	1.4	
		1,2,3,4,6,7,8-HpCDF		33	J
		1,2,3,4,7,8,9-HpCDF	<	2.8	
	2C	2,3,7,8-TCDD	<	2.0	
		1,2,3,7,8-PeCDD	<	1.4	
		1,2,3,4,7,8-HxCDD		7.8	Q, J
		1,2,3,6,7,8HxCDD		31	Q, J
		1,2,3,7,8,9-HxCDD		56	J
		1,2,3,4,6,7,8-HpCDD		1200	
		2,3,7,8-TCDF	<	1.2	
		1,2,3,7,8-PeCDF	<	0.98	
		2,3,4,7,8-PeCDF	<	0.85	
		1,2,3,4,7,8-HxCDF	<	0.71	
		1,2,3,6,7,8-HxCDF	<	0.67	
		2,3,4,6,7,8-HxCDF	<	0.7	
		1,2,3,7,8,9-HxCDF	<	0.83	
		1,2,3,4,6,7,8-HpCDF		19	J
		1,2,3,4,7,8,9-HpCDF	<	1.8	
	3A	2,3,7,8-TCDD	<	1.7	
		1,2,3,7,8-PeCDD	<	1.1	
		1,2,3,4,7,8-HxCDD		7.1	J
		1,2,3,6,7,8HxCDD		35	Q, J
		1,2,3,7,8,9-HxCDD		59	J
		1,2,3,4,6,7,8-HpCDD		1300	
		2,3,7,8-TCDF	<	0.98	
		1,2,3,7,8-PeCDF	<	0.75	
		2,3,4,7,8-PeCDF	<	0.75	
		1,2,3,4,7,8-HxCDF	<	0.63	
		1,2,3,6,7,8-HxCDF	<	0.57	
		2,3,4,6,7,8-HxCDF	<	0.62	
		1,2,3,7,8,9-HxCDF	<	0.79	
		1,2,3,4,6,7,8-HpCDF		17	J
		1,2,3,4,7,8,9-HpCDF	<	1.8	
	3B	2,3,7,8-TCDD	<	1.5	
		1,2,3,7,8-PeCDD	<	1	
		1,2,3,4,7,8-HxCDD		7.2	J
		1,2,3,6,7,8HxCDD		39	J
		1,2,3,7,8,9-HxCDD		59	J
		1,2,3,4,6,7,8-HpCDD		1300	
		2,3,7,8-TCDF	<	1	
		1,2,3,7,8-PeCDF	<	0.78	
		2,3,4,7,8-PeCDF	<	0.77	
		1,2,3,4,7,8-HxCDF	<	0.53	
		1,2,3,6,7,8-HxCDF	<	0.56	
		2,3,4,6,7,8-HxCDF	<	0.56	
		1,2,3,7,8,9-HxCDF	<	0.68	
		1,2,3,4,6,7,8-HpCDF		20	J
		1,2,3,4,7,8,9-HpCDF		2.2	Q, J

Pollutant Type	Run Number	Parameter	Results		Notes
		2,3,7,8-TCDD	<	1.5	
		1,2,3,7,8-PeCDD	<	1.2	
		1,2,3,4,7,8-HxCDD		7.6	J
		1,2,3,6,7,8HxCDD		43	J
		1,2,3,7,8,9-HxCDD		60	J
		1,2,3,4,6,7,8-HpCDD		1400	
		2,3,7,8-TCDF	<	0.98	
	3C	1,2,3,7,8-PeCDF	<	0.97	Q, J
		2,3,4,7,8-PeCDF	<	0.84	
		1,2,3,4,7,8-HxCDF	<	0.64	
		1,2,3,6,7,8-HxCDF	<	0.6	
		2,3,4,6,7,8-HxCDF	<	0.66	
		1,2,3,7,8,9-HxCDF	<	0.79	
		1,2,3,4,6,7,8-HpCDF		27	J
		1,2,3,4,7,8,9-HpCDF	<	1.7	

Pollutant Type	Run Number	Parameter	Results	Notes
	1A	Acenaphthene	430	
		Acenaphthylene	1300	B
		Anthracene	1900	
		Benzo (a) anthracene	4600	
		Benzo (b) fluoranthene	7600	
		Benzo (k) fluoranthene	2700	
		Benzo (ghi) perylene	3900	
		Benzo (a) pyrene	5000	
		Chrysene	5200	
		Dibenz (a,h) anthracene	910	
		Fluoranthene	8300	
		Fluorene	1300	B
		Indeno (1,2,3-cd) pyrene	3100	
		Naphthalene	1600	
		Perylene	1200	B
		Phenanthrene	8500	
		Pyrene	6500	B
	1B	Acenaphthene	470	
		Acenaphthylene	1300	B
		Anthracene	1900	
		Benzo (a) anthracene	5500	
		Benzo (b) fluoranthene	7500	
		Benzo (k) fluoranthene	2600	
		Benzo (ghi) perylene	3800	
		Benzo (a) pyrene	4800	
		Chrysene	6100	
		Dibenz (a,h) anthracene	860	
		Fluoranthene	7700	
		Fluorene	1200	B
		Indeno (1,2,3-cd) pyrene	2900	
		Naphthalene	1500	
		Perylene	1200	B
		Phenanthrene	8000	
		Pyrene	6200	B
	1C	Acenaphthene	450	
		Acenaphthylene	1400	B
		Anthracene	2300	
		Benzo (a) anthracene	6100	
		Benzo (b) fluoranthene	8000	
		Benzo (k) fluoranthene	2400	
		Benzo (ghi) perylene	4100	
		Benzo (a) pyrene	5400	
		Chrysene	5800	
		Dibenz (a,h) anthracene	900	
		Fluoranthene	8300	
		Fluorene	1300	B
		Indeno (1,2,3-cd) pyrene	3200	
		Naphthalene	1600	
		Perylene	1300	B
		Phenanthrene	8700	
		Pyrene	6800	B

Pollutant Type	Run Number	Parameter	Results	Notes
PAHs and Selected SVOCs (ng/L)	2A	Acenaphthene	440	
		Acenaphthylene	1300	B
		Anthracene	1800	
		Benzo (a) anthracene	3500	
		Benzo (b) fluoranthene	5700	
		Benzo (k) fluoranthene	2200	
		Benzo (ghi) perylene	3000	
		Benzo (a) pyrene	3800	B
		Chrysene	3700	
		Dibenz (a,h) anthracene	700	
		Fluoranthene	3500	
		Fluorene	1200	B
		Indeno (1,2,3-cd) pyrene	2300	
		Naphthalene	1500	
		Perylene	930	B
		Phenanthrene	7200	
		Pyrene	5500	
	2B	Acenaphthene	510	
		Acenaphthylene	1500	B
		Anthracene	2300	
		Benzo (a) anthracene	6200	
		Benzo (b) fluoranthene	8100	
		Benzo (k) fluoranthene	2900	
		Benzo (ghi) perylene	4200	
		Benzo (a) pyrene	5400	
		Chrysene	6800	B
		Dibenz (a,h) anthracene	950	
		Fluoranthene	8800	
		Fluorene	1400	B
		Indeno (1,2,3-cd) pyrene	3300	
		Naphthalene	1700	
		Perylene	1300	B
		Phenanthrene	9100	
		Pyrene	7400	
	2C	Acenaphthene	460	
		Acenaphthylene	1300	B
		Anthracene	1900	
		Benzo (a) anthracene	3800	
		Benzo (b) fluoranthene	6200	
		Benzo (k) fluoranthene	2100	
		Benzo (ghi) perylene	3200	
		Benzo (a) pyrene	4100	
		Chrysene	4100	B
		Dibenz (a,h) anthracene	780	
		Fluoranthene	7000	
		Fluorene	1200	B
		Indeno (1,2,3-cd) pyrene	2500	
		Naphthalene	1600	
		Perylene	960	B
		Phenanthrene	7600	
		Pyrene	5800	

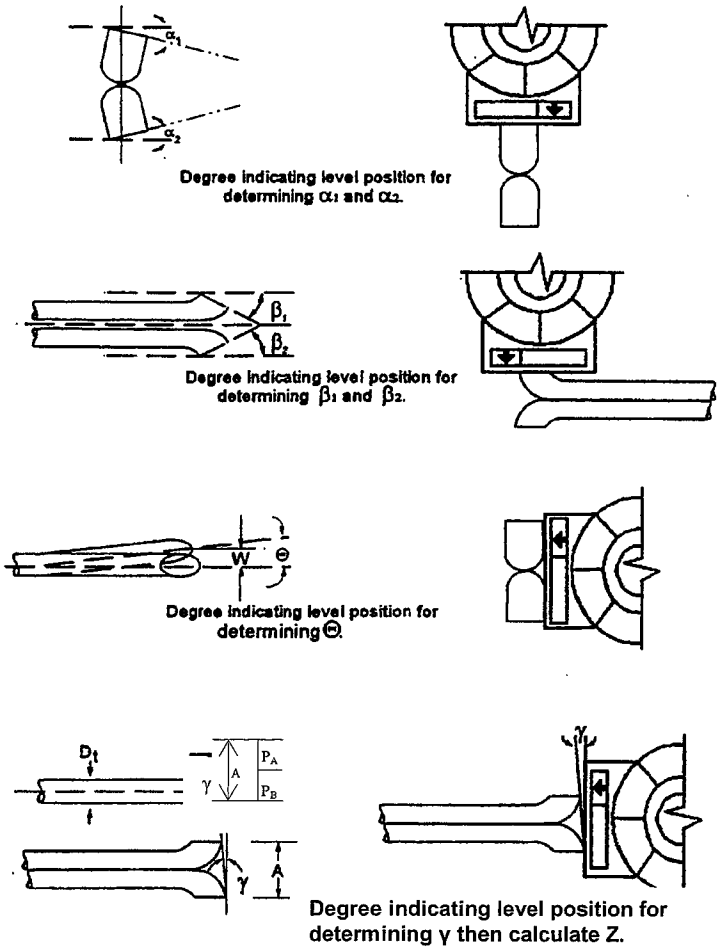
Pollutant Type	Run Number	Parameter	Results	Notes
	3A	Acenaphthene	510	
		Acenaphthylene	1500	B
		Anthracene	2400	
		Benzo (a) anthracene	6200	
		Benzo (b) fluoranthene	8100	
		Benzo (k) fluoranthene	3000	
		Benzo (ghi) perylene	4300	
		Benzo (a) pyrene	5300	
		Chrysene	6900	B
		Dibenz (a,h) anthracene	940	
		Fluoranthene	8800	
		Fluorene	1400	B
		Indeno (1,2,3-cd) pyrene	3300	
		Naphthalene	1700	
		Perylene	1300	B
		Phenanthrene	9300	
		Pyrene	7300	
	3B	Acenaphthene	460	
		Acenaphthylene	1400	B
		Anthracene	2200	
		Benzo (a) anthracene	5700	
		Benzo (b) fluoranthene	7600	
		Benzo (k) fluoranthene	2500	
		Benzo (ghi) perylene	3900	
		Benzo (a) pyrene	5000	
		Chrysene	6000	B
		Dibenz (a,h) anthracene	840	
		Fluoranthene	8400	
		Fluorene	1300	B
		Indeno (1,2,3-cd) pyrene	3000	
		Naphthalene	1600	
		Perylene	1200	B
		Phenanthrene	8600	
		Pyrene	7100	
	3C	Acenaphthene	440	
		Acenaphthylene	1400	B
		Anthracene	1800	
		Benzo (a) anthracene	4000	
		Benzo (b) fluoranthene	5600	
		Benzo (k) fluoranthene	2100	
		Benzo (ghi) perylene	2900	
		Benzo (a) pyrene	3600	
		Chrysene	4100	B
		Dibenz (a,h) anthracene	680	
		Fluoranthene	6500	
		Fluorene	1200	B
		Indeno (1,2,3-cd) pyrene	2200	
		Naphthalene	1500	
		Perylene	860	B
		Phenanthrene	7300	
		Pyrene	5300	

REPORT - APPENDIX D

Quality Assurance/Quality Control Data

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)	1.08	1.08
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)	0.540	0.540
P_B	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.540	0.540
P_A - P_B	(-0.063 to 0.063")	0.000	0.000
P_A/D_t	(1.05 to 1.50)	1.44	1.44
P_B/D_t	(1.05 to 1.50)	1.44	1.44
D_T	(3/16" ≤ D_t ≤ 3/8")	3/8"	3/8"

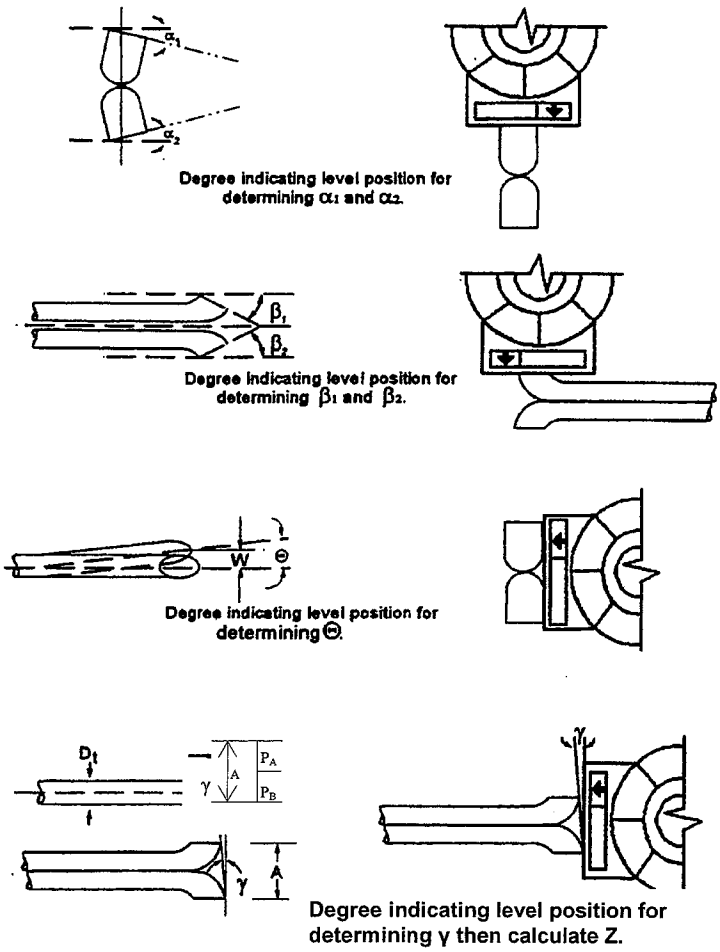
Certification:

I certify that the Type S Pitot Tube/Probe ID# 9-2 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: John Allen 10/27/16
(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)	0.946	0.946
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)	0.473	0.473
P_B	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.473	0.473
P_A - P_B	(-0.063 to 0.063")	0.000	0.000
P_A/D_t	(1.05 to 1.50)	1.26	1.26
P_B/D_t	(1.05 to 1.50)	1.26	1.26
D_T	(3/16" ≤ D_t ≤ 3/8")	3/8"	3/8"

Certification:

I certify that the Type S Pitot Tube/Probe ID# 9-6 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: _____ 10/25/16
(Signature / Date)

MONTROSE ENVIRONMENTAL

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

Thermocouple ID: 9-2

Standard Used ID: CTC-1

EMF Meter ID 1774

Post Test

Temperature Range	Reference Thermometer (°F)	Thermocouple Thermometer (°F)	Temperature Difference (F°)
Ambient Temp.	68	68	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] 11/4/16
(Signature / Date)

MONTROSE ENVIRONMENTAL

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

Thermocouple ID: 9-6

Standard Used ID: CTC-1

EMF Meter ID 1936

Post Test

Temperature Range	Reference Thermometer (°F)	Thermocouple Thermometer (°F)	Temperature Difference (F°)
Ambient Temp.	68	68	0.0

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

Checked by: John Wilson 11/4/16
(Signature / Date)

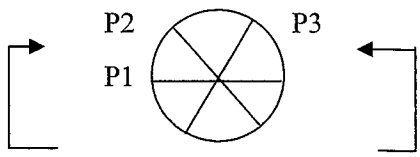
Montrose Air Quality Services (MAQS)
Nozzle Calibration Data Sheet

MONTROSE ENVIRONMENTAL

Date	Calibrated By	Nozzle ID #	Nozzle Diameter (inches)			Hi-Lo	D_{avg}
			D1	D2	D3	Delta D	
10/27/16	JW	0.476	0.476	0.476	0.476	~~0.000~~	0.476
10/27/16	JW	0.337	0.337	0.337	0.337	0.000	0.337

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: _____ 10/27/16 Calibrated by Caliper ID# CAL-017
(Signature / Date)

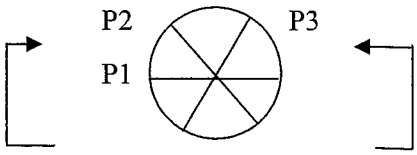
Montrose Air Quality Services (MAQS)
Nozzle Calibration Data Sheet

MONTROSE ENVIRONMENTAL

Date	Calibrated By	Nozzle ID #	Nozzle Diameter (inches)			Hi-Lo	D_{avg}
			D1	D2	D3	Delta D	
10/25/16	JW	0.300	0.300	0.300	0.300	0.000	0.300

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: 10/25/16 Calibrated by Caliper ID# CAL-017
(Signature / Date)

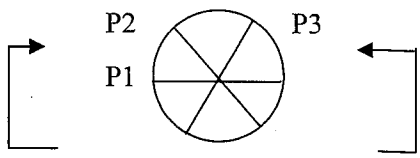
Montrose Air Quality Services (MAQS)
Nozzle Calibration Data Sheet

MONTROSE ENVIRONMENTAL

Date	Calibrated By	Nozzle ID #	Nozzle Diameter (inches)			Hi-Lo	D_{avg}
			D1	D2	D3	Delta D	
10/27/16	JW	0.408	0.408	0.408	0.408	0.000	0.408

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] 10/27/16 Calibrated by Caliper ID# CAL-017
(Signature / Date)

	Previous Cal	New Cal	% Difference
Y	0.989	0.988	0.113
dH	1.924	1.830	5.025

Montrose Air Quality Services, LLC.
EPA Method 5
Meter Box Calibration
Pre-Test Orifice Method
English Meter Box Units, English K' Factor
Apex Orifices

Model #: C-5000
Serial #: 1936

Date: ----------> 08/29/16 60.00
Barometric Pressure: ----------> 30.17 (in. Hg)
Theoretical Critical Vacuum:---> 14.23 (in. Hg)

Jenco 765 NIST Traceability		
NIST 161999	Jenco 765	% Difference
0	0	0.00%
400	396	1.00%
800	800	0.00%
1200	1197	0.25%
1600	1598	0.13%
1900	1892	0.42%

!!!!!!!!!
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)
0.27	20.00	963.100	969.291	6.191	83.0	83.0	83.0	83.0	40	0.2337	17.0	84.0	84.0	84.0
0.60	15.00	980.075	986.886	6.811	83.0	83.0	83.0	83.0	48	0.3408	23.0	85.0	85.0	85.0
1.10	10.00	956.402	962.416	6.014	85.0	85.0	82.0	82.0	55	0.4507	21.5	83.0	83.0	83.0
2.00	10.00	986.886	994.925	8.039	83.0	83.0	83.0	83.0	63	0.6027	20.0	85.0	85.0	85.0
3.60	10.00	969.291	980.075	10.784	84.0	84.0	84.0	84.0	73	0.8099	17.0	85.0	85.0	85.0

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

--- DRY GAS METER --- VOLUME CORRECTED	
Vm(std) (cu ft)	Vm(std) (liters)
6.072	172.0
6.685	189.3
5.905	167.2
7.917	224.2
10.643	301.4

--------- ORIFICE ---------		
VOLUME CORRECTED		VOLUME NOMINAL
Vcr(std) (cu ft)	Vcr(std) (liters)	Vcr (cu ft)
6.046	171.2	6.180
6.606	187.1	6.765
5.835	165.3	5.954
7.789	220.6	7.976
10.467	296.4	10.718

-- DRY GAS METER -- CALIBRATION FACTOR	
Y Value (number)	Variation (number)
0.996	0.008
0.988	0.000
0.988	0.000
0.984	-0.004
0.983	-0.004
Avg Y--> 0.988	

--------- ORIFICE --------- CALIBRATION FACTOR		
dH@		
Value (in H2O)	Value (mm H2O)	Variation (in H2O)
1.703	43.25	-0.127
1.789	45.44	-0.041
1.853	47.07	0.023
1.907	48.43	0.077
1.897	48.19	0.067
Avg dH@--> 1.830	46.47	

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

For Orifice Calibration Factor dH@, the orifice differential pressure in inches of H20 that equates to 0.75 cfm of air at 68 F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +-0.2.

SIGNED: _____ Date: 3/3/16

Y:\1 References\Equipment\Calibrations\Meterboxes\2016 Calibrations\1936\1936 8-29-16

MONTROSE AIR QUALITY SERVICES

Alternative Method 5 Post-Test Calibration Check			
Client:	ArcelorMittal Monessen		
Facility:	Monessen, PA		
Source ID:	Quench Tower		
Project Number:	16-167		
Date:	Oct. 25, 2016		
Control Box ID:	1936		
	Run 1	**Run 2**	**Run 3**
Data Input			
Test time (min)	120	120	120
Volume Dry Gas Metered (dacf)	44.821	44.978	43.954
Meter Temperature (F)	65.1	63.5	67.0
Barometric Pressure (in. Hg)	29.48	29.49	29.26
Orifice Pressure Drop (in. H_2O)	0.46	0.44	0.42
Dry Gas Molecular Weight (lb/lb mol)	28.78	28.79	28.79
Original Meter Correction Value	0.998	0.998	0.998
Meter $DH_@$ (in. H_2O)	1.830	1.830	1.830
Calculated Values			
Dry Gas Meter Calibration check value (Yqa)	**1.015**	**0.982**	**1.000**
Percent Difference (%)	**1.71%**	**-1.56%**	**0.19%**
Results			
Average Dry Gas Meter Calibration Check Value (Yqa)	**0.999**		
Original Meter Correction Value (Y orig)	**0.998**		
Percent Difference (%)	**0.11%**	**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))

	Previous Cal	New Cal	% Difference
Y	1.009	1.006	0.253
dH	1.898	1.977	4.075

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

Model #: C-5000
Serial #: 1774

Date: ----------> 02/02/16 60.00
Barometric Pressure: ----------> 29.15 (in. Hg)
Theoretical Critical Vacuum:---> 13.75 (in. Hg)

Jenco 765 NIST Traceability		
NIST 161999	Jenco 765	% Difference
0	1	0.00%
400	394	1.50%
800	795	0.63%
1200	1189	0.92%
1600	1585	0.94%
1900	1878	1.16%

!!!!!!!!!
IMPORTANT For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.
IMPORTANT The Critical Orifice Coefficient, K', must be entered in English units, (ft)^3*(deg R)^0.5/((in.Hg)*(min)).
!!!!!!!!!

---------- DRY GAS METER READINGS ----------									-CRITICAL ORIFICE READINGS-					
		Volume	Volume	Volume	Initial Temps.		Final Temps.		Orifice	K' Orifice	Actual	-- Ambient Temperature --		
dH (in H2O)	Time (min)	Initial (cu ft)	Final (cu ft)	Total (cu ft)	Inlet (deg F)	Outlet (deg F)	Inlet (deg F)	Outlet (deg F)	Serial# (number)	Coefficient (see above)	Vacuum (in Hg)	Initial (deg F)	Final (deg F)	Average (deg F)
0.29	17.00	740.198	745.339	5.141	73.0	73.0	74.0	73.0	40	0.2337	25.0	70.0	72.0	71.0
0.64	12.00	756.704	762.013	5.309	76.0	74.0	77.0	75.0	48	0.3408	24.0	72.0	73.0	72.5
1.10	10.00	734.100	739.978	5.878	72.0	72.0	73.0	72.0	55	0.4507	21.5	70.0	71.0	70.5
2.00	10.00	762.300	770.150	7.850	76.0	75.0	78.0	75.0	63	0.6027	20.5	73.0	73.0	73.0
3.60	10.00	745.802	756.342	10.540	74.0	73.0	77.0	74.0	73	0.8099	18.0	72.0	72.0	72.0

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

--- DRY GAS METER --- VOLUME CORRECTED	
Vm(std) (cu ft)	Vm(std) (liters)
4.961	140.5
5.106	144.6
5.694	161.3
7.569	214.3
10.232	289.8

--------- ORIFICE ---------		
VOLUME CORRECTED		VOLUME NOMINAL
Vcr(std) (cu ft)	Vcr(std) (liters)	Vcr (cu ft)
5.026	142.3	5.190
5.166	146.3	5.350
5.704	161.5	5.885
7.610	215.5	7.888
10.236	289.9	10.590

-- DRY GAS METER -- CALIBRATION FACTOR	
Y Value (number)	Variation (number)
1.013	0.007
1.012	0.005
1.002	-0.005
1.005	-0.001
1.000	-0.006
Avg Y--> 1.006	

--------- ORIFICE --------- CALIBRATION FACTOR		
dH@		
Value (in H2O)	Value (mm H2O)	Variation (in H2O)
1.921	48.79	-0.056
2.005	50.92	0.028
1.957	49.71	-0.020
2.007	50.98	0.030
1.995	50.67	0.018
Avg dH@--> 1.977	50.21	

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

For Orifice Calibration Factor dH@, the orifice differential pressure in inches of H20 that equates to 0.75 cfm of air at 68 F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +-0.2.

SIGNED: _____ Date: 2/2/16

Y:\1 References\Equipment\Calibrations\Meterboxes\2016 Calibrations\1774\1774 02-02-16

MONTROSE
AIR QUALITY SERVICES

Alternative Method 5 Post-Test Calibration Check			
Client:	ArcelorMittal		
Facility:	Monessen, PA		
Source ID:	Quench Tower		
Project Number:	16-167		
Date:	Oct. 27-28, 2016		
Control Box ID:	1774		
	Run 1	**Run 2**	**Run 3**
Data Input			
Test time (min)	120	120	120
Volume Dry Gas Metered (dacf)	82.841	81.732	79.267
Meter Temperature (F)	70.3	75.9	69.9
Barometric Pressure (in. Hg)	29.52	29.34	29.42
Orifice Pressure Drop (in. H_2O)	1.58	1.51	1.45
Dry Gas Molecular Weight (lb/lb mol)	28.83	28.84	28.84
Original Meter Correction Value	1.006	1.006	1.006
Meter $DH_@$ (in. H_2O)	1.977	1.977	1.977
Calculated Values			
Dry Gas Meter Calibration check value (Yqa)	**0.981**	**0.980**	**0.982**
Percent Difference (%)	**-2.49%**	**-2.63%**	**-2.37%**
Results			
Average Dry Gas Meter Calibration Check Value (Yqa)	**0.981**		
Original Meter Correction Value (Y orig)	**1.006**		
Percent Difference (%)	**-2.50%**	**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.

Trailer	TECO Model 48 Gas Filter Correlation CO Analyzer
Date	22-Nov-02
Analyzer Range	0-200
	new

Test Gas	Concentration (%)	Allowable Interference (ppm)	CO Analyzer Response (ppm)
Carbon dioxide	18.00	2	-1.7
Carbon dioxide	10.1	2	-1.2
Carbon dioxide	0	2	0

Allowable Interference is indicated if the CO analyzer response to each of the gases is less than 1 percent of the applicable measurement range of the analyzer.

CO	Carbon monoxide.
ppmv	Parts per million by volume.
ppm	Parts per million.
USEPA	U.S. Environmental Protection Agency.

SO2 Interference Test for Sulfur Dioxide Analyzer

Model No.:	T-100H
Date:	25-Mar-15
Analyzer Range:	0-500
Serial Number:	206

Test Gas	Gas Cylinder Concentration (ppm_v)	SO2 Analyzer Response (ppm_v)	Difference Percent of Span	Suggested Concentration (ppm_v)
THC	51.12	0.01	0.00%	500 +/- 50 ppm
Oxides of Nitrogen	112.7	0.01	0.00%	200 +/- 20 ppm
Carbon Dioxide	9.895	0.01	0.00%	10.0 +/- 1%
Oxygen	10.15	0.01	0.00%	20.9 +/- 1%
	Total Difference Response		0.0%	

Notes: Acceptance criteria is the sum of analyzer response must be less than 2 percent. Performed in accordance with 40 CFR, Part 60, USEPA Method 7E, Section 6.2 and Method 20, Section 5.4

SO2 Sulfur Dioxide
ppm_v Parts per million by volume.
USEPA U.S. Environmental Protection Agency.

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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:	CC465758	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 %	10.08 %	G1	+/- 1.0% NIST Traceable	05/17/2016
OXYGEN	10.00 %	10.21 %	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:	CC3414	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 %	19.81 %	G1	+/- 0.9% NIST Traceable	05/17/2016
OXYGEN	20.00 %	20.01 %	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 Ave.
Royal Oak, MI 48067-8020
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	AIR COMPLIANCE		
Part Number:	E02NI99E15A1700	Reference Number:	32-400250935-1
Cylinder Number:	SG9150081BAL	Cylinder Volume:	144.3 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62013	Valve Outlet:	350
Gas Code:	CO,BALN	Certification Date:	Sep 09, 2013

Expiration Date: Sep 09, 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
CARBON MONOXIDE	495.0 PPM	503.1 PPM	G1	+/- 1% NIST Traceable	09/09/2013
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	126062428	CC366883	487.1 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 22, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 173, 5000 ppmFS CO, Siemens Ultramat 6	Nondispersive Infrared (NDIR)	Aug 28, 2013

Triad Data Available Upon Request

Notes:

Approved for Release

Airgas

Airgas Specialty Gases
12722 South Wentworth Avenue
Chicago, IL 60628
(773) 785-3000 Fax: (773) 785-1928
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI99E15A1421	Reference Number:	54-124505966-1
Cylinder Number:	CC422759	Cylinder Volume:	144.3 CF
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12015	Valve Outlet:	660
Gas Code:	CO,NO,NOX,BALN	Certification Date:	Aug 07, 2015

Expiration Date: Aug 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
NOX	5.000 PPM	5.033 PPM	G1	+/- 1.4% NIST Traceable	07/31/2015, 08/07/2015
CARBON MONOXIDE	5.000 PPM	5.157 PPM	G1	+/- 0.5% NIST Traceable	07/31/2015
NITRIC OXIDE	5.000 PPM	5.033 PPM	G1	+/- 1.4% NIST Traceable	07/31/2015, 08/07/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062821	CC366710	9.766 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Sep 07, 2018
NTRM	13061131	CC403938	10.14 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 07, 2017
NTRM	13061131	CC403938 NOX	10.14 PPM NOx/NITROGEN	+/- 1.0%	Feb 07, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
(CO-4) Thermo 48i-TLE 1406960657	NDIR	Jul 07, 2015
TC-2 THERMO 42iHL 1407061176 NO	Chemilluminescence	Jul 12, 2015
TC-2 THERMO 42iHL 1407061176 NOx	Chemilluminescence	Jul 12, 2015

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVENUE
ROYAL OAK, MI 48067
248-399-8020 Fax: 248-399-8020
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	AIR COMPLIANCE	Reference Number:	32-400515324-1
Part Number:	E03NI99E15A38W6	Cylinder Volume:	144.3 Cubic Feet
Cylinder Number:	CC274046	Cylinder Pressure:	2015 PSIG
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Valve Outlet:	660
PGVP Number:	B62015	Certification Date:	Apr 14, 2015
Gas Code:	CO,NO,NOX,BALN		

Expiration Date: Apr 14, 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
NOX	10.00 PPM	10.10 PPM	G1	+/- 1% NIST Traceable	04/03/2015, 04/14/2015
CARBON MONOXIDE	10.00 PPM	10.21 PPM	G1	+/- 1% NIST Traceable	03/27/2015
NITRIC OXIDE	10.00 PPM	10.04 PPM	G1	+/- 1% NIST Traceable	03/27/2015, 04/14/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062845	CC401616	9.766 PPM CARBON MONOXIDE/NITROGEN	+/- 0.31	Sep 07, 2018
NTRM	13061133	CC406073	10.14 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 07, 2017
NTRM	13061133	CC406073-NOx	10.14 PPM NOx/NITROGEN	+/-1.0%	Feb 07, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54 Nicolet 6700 CO	FTIR	Apr 06, 2015
NO CAI-600 EN 176	Chemiluminescence	Mar 24, 2015
NOx CAI-600 EN 176	Chemiluminescence	Mar 24, 2015

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas Specialty Gases
12722 South Wentworth Avenue
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(773) 785-3000 Fax: (773) 785-1928
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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A00A9	Reference Number:	54-124409997-1
Cylinder Number:	CC502047	Cylinder Volume:	144.0 Cubic Feet
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2014 PSIG
PGVP Number:	B12013	Valve Outlet:	660
Gas Code:	NO2,BALN	Certification Date:	Dec 31, 2013

Expiration Date: Dec 31, 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	55.00 PPM	57.19 PPM	G1	+/- 2%	12/31/2013, 12/31/2013
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NO2	124288126109	CC320547	57.85 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Oct 25, 2015

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS Mulligas 17707558	FTIR	Dec 30, 2013

Triad Data Available Upon Request

Permanent Notes:OXYGEN ADDED TO MAINTAIN STABILITY

Notes:

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	OAKWOOD		
Part Number:	E02NI99E15A0257	Reference Number:	32-400485381-1
Cylinder Number:	CC403407	Cylinder Volume:	144.4 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62015	Valve Outlet:	660
Gas Code:	SO2,BALN	Certification Date:	Feb 04, 2015

Expiration Date: Feb 04, 2019

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	25.00 PPM	25.43 PPM	G1	+/- 1.0% NIST Traceable	01/28/2015, 02/04/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060305	CC403758	16.82 PPM SULFUR DIOXIDE/NITROGEN	+/-0.9%	Apr 26, 2016

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54 Nicolet 6700 SO2	FTIR	Jan 12, 2015

Triad Data Available Upon Request

Signature on file

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

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Montrose CEM Verification of Gas Dilution System for Field Instrument Calibrations
Based on EMTIC TM-205

Client	ArcelorMittal	Date	October 31, 2017
Project No	16-167	Location	Stack
Plant	Monessen, PA	Series No.	4040
Unit	Quench Tower	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	SO2	
Concentration of Protocol Gas Used	250.6	CC405423

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	50.00		-2.00%
Instrument Response 1	48.8	-0.41%	
Instrument Response 2	49.1	0.20%	
Instrument Response 3	49.1	0.20%	
Average Response	49.00		
		+/- 2 % Allowable	+/- 2 % Allowable
Predicted Concentration 2	25.43		0.01%
Instrument Response 1	25.40	-0.13%	
Instrument Response 2	25.40	-0.13%	
Instrument Response 3	25.50	0.26%	
Average Response	25.43		
		+/- 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	25.43	CC403407
Instrument Response 1	25.5	0.28%
Instrument Response 2	25.5	
Instrument Response 3	25.5	
Average Response	25.50	
		+/- 2 % Allowable

Environics®

nqa ISO 9001 Registered ANAB ACCREDITED

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
Environics Inc. • 69 Industrial Park Road East • Tolland, CT 06084 • (860) 872-1111 • Fax: (860) 870-9333
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: Perrie Lundmark Date: 4-20-16

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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: Peric 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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Montrose Minimum Detection Limits for FTIR Compounds			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	Nov. 1, 2016	**Analyte**	HCL, HF, HCN

Scan	Date	Time	HCl (ppm_{wv})	HF (ppm_{wv})	HCN (ppm_{wv})
6	11/1/2017	9:58:57 AM	-0.129	0.051	-0.181
7	11/1/2017	9:59:56 AM	-0.176	0.053	-0.140
8	11/1/2017	10:00:56 AM	-0.212	0.054	-0.020
9	11/1/2017	10:01:55 AM	-0.237	0.057	-0.267
10	11/1/2017	10:02:54 AM	-0.248	0.053	-0.228
11	11/1/2017	10:03:54 AM	-0.300	0.053	-0.124
12	11/1/2017	10:04:53 AM	-0.353	0.055	0.055
Averages			-0.236	0.054	-0.129
Standard Deviation			0.075	0.002	0.114
Calculated MDL (3 x SD, or average)			0.22	0.054	0.34
MDL Used			0.22	0.054	0.34

Montrose Raw Spike Recovery Data			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	Nov. 1, 2016	**Analyte**	HCl

Data Point	Scan #	Date	Time	Analyte, Direct (ppmwv)	SF6, Direct (ppmwv)
1	107	11/1/2016	10:41:37 AM	43.94	5.19
2	108	11/1/2016	10:41:52 AM	43.95	5.20
3	109	11/1/2016	10:42:06 AM	43.68	5.15
4	110	11/1/2016	10:42:21 AM	43.52	5.13
5	111	11/1/2016	10:42:37 AM	43.49	5.12
AVERAGES				**43.72**	**5.16**

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	Quench Tower
Operation	Normal
Date	Nov. 1, 2016
Tester(s)	BC, JW, TM, CB

Calibration Gas	Conc.	Tank ID	Conc. Units	Response Time (sec)
HCl	44.63	CC222025	ppmdv	300
SF_6	5.229		ppmdv	

Spike 1			**% of Standard**	**Pass/Fail**
Direct Ethylene Standard Concentration	ppm_{wv}	43.72	98%	Pass
Direct SF_6 Standard Concentration	ppm_{wv}	5.158	99%	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 (%)		9.15	$\leq 10\%$	Pass
Predicted Spiked Analyte Concentration		3.93		
Spike Recovery (%)		85.97	$70 \leq \% \leq 130$	Pass

Montrose Raw Spike Recovery Data			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	Nov. 1, 2016	**Analyte**	HCN

Data Point	Scan #	Date	Time	Analyte, Direct (ppmwv)	SF6, Direct (ppmwv)
1	62	11/1/2016	10:21:22 AM	95.24	5.27
2	63	11/1/2016	10:21:37 AM	95.41	5.17
3	64	11/1/2016	10:21:52 AM	95.22	5.17
4	65	11/1/2016	10:22:07 AM	95.25	5.17
5	66	11/1/2016	10:22:22 AM	95.24	5.17
AVERAGES				**95.27**	**5.19**

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	Quench Tower
Operation	Normal
Date	Nov. 1, 2016
Tester(s)	BC, JW, TM, CB

Calibration Gas	Conc.	Tank ID	Conc. Units	Response Time (sec)
HCN	100.10	EB0074795	ppmdv	50
SF_6	5.04		ppmdv	

Spike 1			**% of Standard**	**Pass/Fail**
Direct Hydrogen Cyanide Concentration	ppm_{wv}	95.27	95%	Pass
Direct SF_6 Concentration	ppm_{wv}	5.188	103%	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 (%)		7.97	$\leq 10\%$	Pass
Predicted Spiked Analyte Concentration		7.45		
Spike Recovery (%)		94.67	$70 \leq \% \leq 130$	Pass

Montrose Raw CTS Data			
Client	ArcelorMittal	**Unit**	Quench Tower
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	Nov. 1, 2016	**Analyte**	HCN

Data Point	Date	Time	Analyte,Calibration Gas (ppmwv)
Pre Test Internal			
1	11/1/2016	10:21:22 AM	95.24
2	11/1/2016	10:21:37 AM	95.41
3	11/1/2016	10:21:52 AM	95.22
4	11/1/2016	10:22:07 AM	95.25
5	11/1/2016	10:22:22 AM	95.24
AVERAGES			**95.27**
Pre Test External			
1	11/1/2016	11:03:35 AM	93.00
2	11/1/2016	11:04:35 AM	93.05
3	11/1/2016	11:05:35 AM	93.42
AVERAGES			**93.16**
Post Test 1 External			
1	11/1/2016	3:57:26 PM	95.38
2	11/1/2016	3:58:26 PM	96.13
3	11/1/2016	3:59:26 PM	96.50
AVERAGES			**96.00**
Post Test 2 External			
1	11/2/2016	10:50:10 AM	94.51
2	11/2/2016	10:51:10 AM	94.62
3	11/2/2016	10:52:10 AM	94.60
AVERAGES			**94.58**
Post Test 3 External			
1	11/2/2016	2:59:09 PM	94.34
2	11/2/2016	3:00:08 PM	94.30
3	11/2/2016	3:01:07 PM	94.26
AVERAGES			**94.30**

Montrose FTIR Stability Check Data (Calibration Transfer Standard - CTS)

Client	ArcelorMittal
Project No	16-167
Plant	Monessen, PA
Unit	Quench Tower
Operation	Normal
Tester(s)	Nov. 1, 2016
Date	BC, JW, TM, CB

Calibration Transfer Standard Gas	Concentration	Concentration Units	Tank ID
HCN	100.10	ppm_{dv}	EB0074795
SF6	5.04	ppm_{dv}	

	CTS Concentration of Analyte (ppm_{dv})	Difference From Cylinder Value (%)	Pass/Fail
Internal	95.27	-4.82	Pass
	CTS Concentration of Analyte (ppm_{dv})	**Difference From Direct Value (%)**	**Pass/Fail**
External	93.16	-2.22	Pass
Post Run 1	96.00	0.77	Pass
Post Run 2	94.58	-0.73	Pass
Post Run 3	94.30	-1.02	Pass
		Allowable +/- 5%	

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

WILLIAM P. COWELL

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 7TH DAY OF JANUARY 2014 AND EFFECTIVE UNTIL JANUARY 6TH, 2019

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Theresa Lowe, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2009-336

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

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

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

1995

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

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 Rameell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-768

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOHN E. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 20TH DAY OF MARCH 2013 AND EFFECTIVE UNTIL MARCH 19TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-768

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOHN E. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

HAZARDOUS METALS MEASUREMENT SAMPLING METHODS

ISSUED THIS 20TH DAY OF MARCH 2013 AND EFFECTIVE UNTIL MARCH 19TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-768

OPACITAIR

OpacitAir Smoke School, LLC

certifies that

CHRISTOPHER BURKOVICH of MONTROSE AIR QUALITY SERVICES

Has met all of the requirements of EPA Reference Method 9 & 22

and is qualified as a Visible Emissions Observer.

Date: AUGUST 22 ,2016

Valid for 6 months after above date.

James Hudson

James Hudson, President

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REPORT - APPENDIX E

Sample Calculations

Method 5/202

Montrose SAMPLE CALCULATIONS
CEMS and Particulate Matter
ArcelorMittal
16-167
Monessen, PA
Quench Tower
Normal
Top of Quench Tower
Run 1
Oct. 27-28, 2016

V_f	0.0	ml	$T_{standard}$	68	°F
V_i	0.0	ml	$P_{standard}$	760	mm Hg
W_f	2,951.1	g	K1M4	0.04706	scf/ml
W_i	2,675.8	g	K3M4	0.04715	scf/g
V_m	52.148	dacf	K1M5	17.64	°R/in. Hg
			K5M5	0.0945	
Y_d	0.998		K3	0.0154	gr/mg
P_{bar}	29.52	in. Hg	$V/n_{standard}$	385.3	ft^3/lb-mol
dH avg	0.58	in. H_2O	K_p	85.49	
T_m	69.5	°F	p_s	0.7899	g/ml
O_2	20.64	% dv	π	3.141593	
CO_2	0.05	% dv	D_s (or L)	600.00	in.
P_g	0.10	in. H_2O	Stack Width (W)	216.00	in.
C_p	0.84		D_n	0.337	in.
SQRT dP avg	0.268	in. $H_2O^{1/2}$	Theta	120	min
F_d	NA	dscf/MMBtu	T_{savg}	171.6	°F
			Quench Frequency	3.30	Quenches/hour
			Quench Duration	5.00	minutes/Quench
			A_n	0.000619	ft^2
Filterable Particulate Data					
V_a	200	ml	AW Final W2	110,853.2	mg
AB Final W1	114,845.9	mg	AW Tare W1	110,839.0	mg
AB Final W2	114,846.3	mg	AW Tare W2	110,839.0	mg
AB Tare W1	114,845.8	mg	Filter Final W1	354.7	mg
AB Tare W2	114,845.9	mg	Filter Final W2	354.6	mg
V_{aw}	398	ml	Filter Tare W1	345.3	mg
AW Final W1	110,853.2	mg	Filter Tare W2	345.2	mg
Condensable Particulate Data					
O Fraction Volume	170	ml	IO Fraction Volume	186	ml
			Sample Aliquot Volume	10	ml
O Final W1	2,282.8	mg	IO Final W1	2,334.6	mg
O Final W2	2,282.8	mg	IO Final W2	2,334.5	mg
O Tare W1	2,277.4	mg	IO Tare W1	2,326.8	mg
O Tare W2	2,277.4	mg	IO Tare W2	2,326.7	mg
			Normality	0.1	N
			Volume of Titrant	0.400	ml

Volume of Water Vapor Condensed ($V_{wc[std]}$) **M4 Eq. 12.1.2**

$V_{wc(std)} = K1M4 * (V_f - V_i)$

K1M4=	0.04706	scf/ml
V_f=	0.0	ml
V_i=	0.0	ml
$V_{wc(std)}$=	0.000	scf

Volume of Water Vapor Collected in Silica Gel ($Vw_{sg[std]}$) **M4 Eq. 12.1.3**

$V_{wsg(std)} = K3M4 * (W_f - W_i)$

K3M4=	0.04715	scf/g
W_f=	2,951.1	g
W_i=	2,675.8	g
$V_{wsg(std)}$=	12.980	scf

Total Volume of Water Vapor in Gas Sample ($V_{w(std)}$)

$V_{w(std)} = V_{wc(std)} + V_{wsg(std)}$

$V_{wc(std)}$=	0.000	scf
$V_{wsg(std)}$=	12.980	scf
$V_{w(std)}$=	12.980	scf

Volume of Gas Metered, Dry Basis, Standard (Vm[std]) **M5 Eq. 5-1**

$V_{m(std)} = (K1M5 * V_{m(dacf)} * Y_d * (P_{bar} + (dH\ avg / 13.6))) / (T_m + 459.67°F)$

K1M5=	17.64	°R/in. Hg
$V_{m(dacf)}$=	52.148	dacf
Y_d=	0.9980	
P_{bar}=	29.52	in. Hg
dH avg=	0.58	in. H_2O
T_m=	69.5	°F
$V_{m(std)}$=	51.290	dscf

Water Vapor in the Gas Stream **M5 Eq. 5-3**

B_{ws} Used = the Lower of

$V_{w(std)} / (V_{m(std)} + V_{w(std)})$ $SP_{H2O@Tsavg} / P_s$

$B_{ws} = V_{w(std)} / (V_{m(std)} + V_{w(std)})$ EQUATION ONE

$V_{w(std)}$=	12.980	scf
$V_{m(std)}$=	51.290	dscf
B_{ws}=	0.2020	vol. fraction

$B_{ws} = SP_{H2O@Tsavg} / P_s$ EQUATION TWO

$SP_{H2O@Tsavg} = EXP((C8 / T) + C9 + (C10 * T) + (C11 * T^2) + (C12 * T^3) + (C13 * Ln(T))) * (29.921 / 14.696)$

The saturation pressure of water at stack temperature 1997 ASHRAE Handbook page 6.2 Eq. 6

$T = T_{savg} + 459.67°F$

T_{savg}=	171.6	°F	
T=	631.3	°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		
$SP_{H2O@Tsavg}$=	12.68	in. Hg	
P_s=	29.53	in. Hg	
B_{ws}=	0.4294	vol. fraction	With a maximum allowable value of 1.0
B_{ws} Used=	0.2020	vol. fraction	

Carbon Monoxide and Nitrogen in Gas Stream

$CO + N_2 = 100 - (CO_2\ \%\ dv + O_2\ \%\ dv)$

CO_2=	0.05	% dv
O_2=	20.64	% dv
$CO + N_2$=	79.30	% dv

Molecular Weight of Dry Gas Stream **M3 Eq. 3-1**

$M_d = 0.440 * CO_2\ \%\ dv + 0.320 * O_2\ \%\ dv + 0.28 * (CO\ \%\ dv + N_2\ \%\ dv)$

CO_2=	0.05	% dv
O_2=	20.64	% dv
$CO + N_2$=	79.30	% dv
M_d=	28.83	lb/lb-mol

Molecular Weight of Wet Gas Stream **M2 Eq. 2-6**

$M_s = M_d * (1 - B_{ws}) + 18 * B_{ws}$

M_d=	28.83	lb/lb-mole
B_{ws}=	0.2020	vol. fraction
M_s=	26.65	lb/lb-mole

Stack Absolute Pressure **M2**

$P_s = P_{bar} + P_g / 13.6$

P_{bar}=	29.52	in. Hg
P_g=	0.10	in. H_2O
P_s=	29.53	in. Hg

Stack Gas Velocity **M2 Eq. 2-7**

$V_s = K_p * C_p$ * SQRT dP avg * SQRT((T_{savg} + 459.67°F) / (P_s * M_s))

K_p=	85.49	
C_p=	0.84	
SQRT dP avg=	0.2682	in. $H_2O^{1/2}$
T_{savg}=	171.6	°F
P_s=	29.53	in. Hg
M_s=	26.65	lb/lb-mol
V_s=	17.25	ft/s

Area of the Stack, Circular

As = PI * (DS1) / 4 * (1 ft / 12 in)2

PI=	3.141593	
D_s=	NA	in.
A_s=	NA	ft^2

Area of the Stack, Rectangular

$A_s = L * W * (1 \text{ ft} / 12 \text{ in})^2$

L=	600.00	in.
W=	216.00	in.
A_s=	900.000	ft^2

Volumetric Flow of Gas Stream, Actual Conditions

$Q_{acfm} = V_s * A_s$ * (60 sec / 1 min)

V_s=	17.25	ft/s
A_s=	900.00	ft^2
Q_{acfm}=	931,712	acfm

Volumetric Flow of Gas Stream, Standard Conditions

$Q_{scfm} = Q_{acfm}$ * (($T_{standard}$ + 459.67°F) / (T_{savg} + 459.67°F)) * (P_s / $P_{standard}$)

Q_{acfm}=	931,712	acfm
$T_{standard}$=	68	°F
T_{savg}=	171.6	°F
P_s=	29.53	in. Hg
$P_{standard}$=	29.92	in. Hg
Q_{scfm}=	768,554	scfm

Volumetric Flow of Gas Stream, Standard Conditions, Dry Basis

$Q_{dscfm} = Q_{scfm}$ * (1 - B_{ws})

Q_{scfm}=	768,554	scfm
B_{ws}=	0.2020	vol. fraction
Q_{dscfm}=	613,334	dscfm

Area of Nozzle

$A_n = PI * (D_n^2) / 4 * (1 \text{ ft} / 12 \text{ in})^2$

PI=	3.141593	
D_n=	0.337	in.
A_n=	0.000619	ft^2

Percent Isokinetic **M5 Eq. 5-8**

I = K5M5 * (T_{savg} + 459.67°F) * $V_{m(std)}$ / (P_s * V_s * A_n * Theta * (1 - B_{ws}))

K5M5=	0.0945	
T_{savg}=	171.6	°F
$V_{m(std)}$=	51.290	dscf
P_s=	29.53	in. Hg
V_s=	17.25	ft/s
A_n=	0.000619	ft^2
Theta=	120	min
B_{ws}=	0.2020	vol. fraction
I=	101.3	%

Acetone Blank Concentration **M5 Eq. 5-4**

$C_a = m_a / (V_a * p_a)$

m_a = Average Final Weight (Total) After Evaporation - Average Tare Weight

Final (Total) Weight 1 After Evaporation=		114,845.9 mg	
Final (Total) Weight 2 After Evaporation=		114,846.3 mg	
Final (Total) Weight Difference (Absolute Value)=		0.40 mg	Must be ≤ 0.5 mg
Average Final (Total) Weight After Evaporation=		114,846.10 mg	
Tare Weight 1=		114,845.8 mg	
Tare Weight 2=		114,845.9 mg	
Tare Weight Difference (Absolute Value)=		0.10 mg	Must be ≤ 0.5 mg
Average Tare Weight=		114,845.85 mg	
m_a=	0.25 mg	With a minimum allowable value of 0	
V_a=	200 ml		
p_a=	0.7899 g/ml		
C_a=	0.0016 mg/g	With a maximum allowable value of 0.01	

Weight of Acetone **M5 Eq. 5-5**

$W_a = C_a * V_{aw} * p_a$

C_a=	0.0016 mg/g
V_{aw}=	398 ml
p_a=	0.7899 g/ml
W_a=	0.4975 mg

Total Weight of Filterable Particulate (Method 5)

$m_n = m_f + (W_{ag} - W_a)$

W_{ag} = Average Final (Total) Weight - Average Tare Weight

Acetone Wash Final (Total) Weight 1=		110,853.2 mg	
Acetone Wash Final (Total) Weight 2=		110,853.2 mg	
Acetone Wash Final (Total) Difference (Absolute Value)=		0.00 mg	Must be ≤ 0.5 mg
Average Final (Total) Weight=		110,853.20 mg	
Tare Weight 1=		110,839.0 mg	
Tare Weight 2=		110,839.0 mg	
Tare Weight Difference (Absolute Value)=		0.00 mg	Must be ≤ 0.5 mg
Average Tare Weight=		110,839.00 mg	
W_{ag}=	14.20 mg		
W_a=	0.50 mg		
$W_{ag} - W_a$=	13.70 mg	With a minimum allowable value of 0	

m_f = Average Final (Total) Weight - Average Tare Weight

Filter Final (Total) Weight 1=		354.7 mg	
Filter Final (Total) Weight 2=		354.6 mg	
Filter Final (Total) Difference (Absolute Value)=		0.10 mg	Must be ≤ 0.5 mg
Average Final (Total) Weight=		354.65 mg	
Tare Weight 1=		345.3 mg	
Tare Weight 2=		345.2 mg	
Tare Weight Difference (Absolute Value)=		0.10 mg	Must be ≤ 0.5 mg
Average Tare Weight=		345.25 mg	
m_f=	9.40 mg	With a minimum allowable value of 0	
m_n=	23.10 mg		

Filterable Particulate Emission Concentration$_{(gr/dscf)}$ **M5 Eq. 5-6**

$EC_{(gr/dscf)} = K3 * m_n / V_{m(std)}$

K3=	0.0154 gr/mg
m_n=	23.10 mg
$V_{m(std)}$=	51.290 dscf
$EC_{(gr/dscf)}$=	0.0069 gr/dscf

Method 202 Field Train Condensable Water Blank Concentration (m_{tb})

m_{tb} = (Average Final (Total) Weight - Average Tare Weight) - Mass of Ammonium (NH_4)

Final (Total) Weight 1 After Evaporation=		2,285.2 mg	
Final (Total) Weight 2 After Evaporation=		2,285.0 mg	
Final (Total) Weight Difference (Absolute Value)=		0.20 mg	Must be ≤ 0.5 mg
Average Final (Total) Weight After Evaporation=		2,285.10 mg	
Tare Weight 1=		2,284.8 mg	
Tare Weight 2=		2,284.7 mg	
Tare Weight Difference (Absolute Value)=		0.10 mg	Must be ≤ 0.5 mg
Average Tare Weight=		2,284.75 mg	
Normality of Titrant=		0.1 N	
Volume of Titrant=		0.001 ml	
Mass of Ammonium (NH_4)=		0.002 mg	
m_{tb}=	0.35 mg		

Method 202 Field Train Condensable Hexane Blank Concentration (m_{ob})

m_{ob} = Average Final (Total Weight) - Average Tare Weight			
Final (Total) Weight 1 After Evaporation=		2,343.4 mg	
Final (Total) Weight 2 After Evaporation=		2,343.5 mg	
Final (Total) Weight Difference (Absolute Value)=		0.10 mg	Must be ≤ 0.5 mg
Average Final (Total) Weight After Evaporation=		2,343.45 mg	
Tare Weight 1=		2,343.2 mg	
Tare Weight 2=		2,343.2 mg	
Tare Weight Difference (Absolute Value)=		0.00 mg	Must be ≤ 0.5 mg
Average Tare Weight=		2,343.20 mg	
m_{ob}=	0.25 mg		

Method 202 Field Train Blank Correction

$m_{fb} = m_{ob} + m_{tb}$	
m_{ob}=	0.25 mg
m_{tb}=	0.35 mg
m_{fb}=	0.60 mg

Total Weight of Inorganic Particulate (Method 202)

Inorganic Fraction Weight Gain = Average Final (Total) Weight - Average Tare Weight		
Inorganic Fraction Volume=	186 ml	
Sample Aliquot Volume=	10 ml	
Sample Volume Less Alliquot Volume=	176 ml	
Final (Total) Weight 1 After Evaporation=	2,334.6 mg	
Final (Total) Weight 2 After Evaporation=	2,334.5 mg	
Final (Total) Weight Difference (Absolute Value)=	0.10 mg	Must be ≤ 0.5 mg
Average Final (Total) Weight After Evaporation=	2,334.55 mg	
Tare Weight 1=	2,326.8 mg	
Tare Weight 2=	2,326.7 mg	
Tare Weight Difference (Absolute Value)=	0.10 mg	Must be ≤ 0.5 mg
Average Tare Weight=	2,326.75 mg	
Inorganic Fraction Weight=	7.80 mg	
Inorganic Fraction Weight Volume Corrected=	8.24 mg	
Weight of Inorganic Fraction (Ammonium Corrected) = Inorganic Fraction Weight Volume Corrected - Mass of Ammonium (NH_4)		
Normality of Ammonium Hydroxide (NH_4OH)=	0.1 N	
Volume of Titrant=	0.400 ml	
Mass of Ammonium (NH_4)=	0.681 mg	
Weight of Inorganic Fraction (Ammonium Corrected)=	7.56 mg	

Total Weight of Organic Particulate (Method 202)

Organic Fraction Weight Gain = Average Final (Total) Weight - Average Tare Weight		
Organic Fraction Volume=	170 ml	
Sample Aliquot Volume=	0 ml	
Sample Volume Less Alliquot Volume=	170 ml	
Final (Total) Weight 1 After Evaporation=	2,282.8 mg	
Final (Total) Weight 2 After Evaporation=	2,282.8 mg	
Final (Total) Weight Difference (Absolute Value)=	0.00 mg	Must be <=0.5 mg
Average Final (Total) Weight After Evaporation=	2,282.80 mg	
Tare Weight 1=	2,277.4 mg	
Tare Weight 2=	2,277.4 mg	
Tare Weight Difference (Absolute Value)=	0.00 mg	Must be <=0.5 mg
Average Tare Weight=	2,277.40 mg	
Organic Fraction Weight=	5.40 mg	

Total Weight of Condensable Particulate (Method 202)

Total Condensable Weight = Organic Fraction Weight Volume Corrected + Inorganic Fraction Weight (Ammonium Corrected) - m_{fb}	
Organic Fraction Weight Volume Corrected=	5.40 mg
Weight of Inorganic Fraction (Ammonium Corrected)=	7.56 mg
m_{fb}=	0.60 mg
m_n=	12.36 mg

Condensable Particulate Emission Concentration$_{(gr/dscf)}$ **M5 Eq. 5-6**

$EC_{(gr/dscf)} = K3 * m_n / V_{m(std)}$	
K3=	0.0154 gr/mg
m_n=	12.36 mg
$V_{m(std)}$=	51.290 dscf
$EC_{(gr/dscf)}$	0.0037 gr/dscf

Total Weight of Particulate as FPM & CPM (Methods 5/202)

Total Weight Methods 5/202 = Blank Corrected Method 5 + Blank Corrected Method 202	
Total Weight Blank Corrected Method 5=	23.10 mg
Total Weight Blank Corrected Method 202=	12.36 mg
m_n=	35.47 mg

Total PM Emission Concentration$_{(gr/dscf)}$ **M5 Eq. 5-6**

$EC_{(gr/dscf)} = K3 * m_n / V_{m(std)}$	
K3=	0.0154 gr/mg
m_n=	35.47 mg
$V_{m(std)}$=	51.290 dscf
$EC_{(gr/dscf)}$	0.0106 gr/dscf

Method 5

Montrose SAMPLE CALCULATIONS
Particulate Matter Test Results
ArcelorMittal
16-167
Monessen, PA
Quench Tower
Normal
Oct. 27-28, 2016
Top of Quench Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,511.2	g	K1method 4	0.04707	scf/ml
Wi	4,152.8	g	K2method 4	0.04715	scf/g
Vm	82.841	0.000	K1method 5	17.64	R/in. Hg
Vm	0.000	0.000	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.52	in. Hg	Kp	85.49	
dHavg	1.58	in. H2O			
Tm	70.3	F	π	3.141593	
O2	20.64	% dv	Ds (or L)	600.00	inches
CO2	0.05	% dv	Stack Width (W)	216.00	inches
Pg	0.01	in. H2O	Dn	0.408	inches
Cp	0.84		Time	120	minutes
$(dP)^{1/2}$avg	0.281	in. H2O^1/2	Tsavg	174.2	F
F_d	NA	dscf/MMBtu			
Quench Duration	5.0	minutes/Quench			
Quench Frequency	3.30	Quenches/hour			

Particulate Data

Acetone Wash Volume (Vaw)	91	ml
Acetone Wash Weight Gain	136.0	mg
Front Half Filter Particulate	116.0	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=	4,511.2 g
Wi=	4,152.8 g
Vwsg(std)=	16.899 scf

3. Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000 scf
Vwsg(std)=	16.899 scf
Vw(std)=	16.899 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=	82.841	0.000
Volume metered in dry actual liters=	0.000	0.000
Vm=	82.841 dacf	

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	82.841	dacf
$Vm(m^3)$=	2.346	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=	82.841	dacf
Yd=	1.0060	
Pbar=	29.52	in. Hg
dHavg=	1.58	in. H2O
Tm=	70.3	F
Vm(std)=	82.151	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	82.151	dscf
$Vm(std)m^3$=	2.326	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=	174.2	F
T=	633.8	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	
$SP_{H2O@Tsavg}$=	13.43	in. Hg
Ps=	29.52	in. Hg
Bws=	0.4550	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	16.899	scf
Vm(std)=	82.151	dscf
Bws=	0.1706	vol. fraction
Bws used=	0.1706	vol. fraction

7. Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.05	% dv
O2=	20.64	% dv
CO + N2=	79.30	% dv

8. Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.05	% dv
O2=	20.64	% dv
CO + N2=	79.30	% dv
Md=	28.83	lb/lb-mole

9. Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.83	lb/lb-mole
Bws=	0.1706	vol. fraction
Ms=	26.99	lb/lb-mole

10. Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.52	in. Hg
Pg=	0.01	in. H2O
Ps=	29.52	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=	0.2810	in. H2O^1/2
Tsavg=	174.2	F
Ps=	29.52	in. Hg
Ms=	26.99	lb/lb-mole
Vs=	18.00	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

13. Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	18.00	ft/s
As=	900.00	ft2
Qacfm=	972,268	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	972,268	acfm
Qacm/min=	27,532	acm/min

14. Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	972,268	acfm
Tstandard=	68	F
Tsavg=	174.2	F
Ps=	29.52	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	798,697	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	798,697	scfm
Qscm/min=	22,617	scm/min

15. Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	798,697	scfm
Bws=	0.1706	vol. fraction
Qdscfm=	662,434	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	662,434	dscfm
Qdscm/min=	18,758	dscm/min

16. Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.408	inches
An=	0.000908	ft2

17. Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	174.2	F
Vm(std)=	82.151	dscf
Ps=	29.52	in. Hg
Vs=	18.00	ft/s
An=	0.000908	ft2
Theta=	120	minutes
Bws=	0.1706	vol. fraction
I=	102.50	%

18. Total Weight of Particulate

m_n = acetone wash weight gain - Wa + condensible + filter weight gain

Acetone wash weight gain - Wa=	136.0000	mg	With a minimum allowable value of 0
Filter weight gain=	116.0000	mg	With a minimum allowable value of 0
m_n=	252.0000	mg	

19. Emission Concentration (mg/DSCM)

Particulate(gr/dscf) = (m_n / Vm(std))

m_n=	252.0000	mg
Vm(std)=	2.326	dscm
Particulate(mg/dscm)=	108.33	mg/dscm

Method 29

Montrose SAMPLE CALCULATIONS
Metals Testing Results
ArcelorMittal
16-167
Monessen, PA
Quench Tower
Normal
Oct. 27-28, 2016
Top of Quench Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,511.2	g	K1method 4	0.04707	scf/ml
Wi	4,152.8	g	K2method 4	0.04715	scf/g
	82.841	dacf	K1method 5	17.64	R/in. Hg
	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.52	in. Hg	Kp	85.49	
dHavg	1.58	in. H2O			
Tm	70.3	F	π	3.141593	
O2	20.64	% dv	Ds (or L)	600.00	inches
CO2	0.05	% dv	Stack Width (W)	216.00	inches
Pg	0.01	in. H2O	Dn	0.408	inches
Cp	0.84		Time	120	minutes
$(dP)^{1/2}$avg	0.281	in. H2O^1/2	Tsavg	174.2	F
F_d	NA	dscf/MMBtu	Quenching Frequency	3.30	Quenches/hour
			Quench Duration	5.00	minutes/Quench

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

Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	4,511.2	g
Wi=	4,152.8	g
Vwsg(std)=	16.899	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	16.899	scf
Vw(std)=	16.899	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=	82.841	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	82.841	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	82.841	dacf
$Vm(m^3)$=	2.346	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=	82.841	dacf
Yd=	1.0060	
Pbar=	29.52	in. Hg
dHavg=	1.58	in. H2O
Tm=	70.3	F
Vm(std)=	82.151	dscf

$Vm(std)m^3 = Vm(std) * (1\ m^3 / 35.3145\ cf)$

Vm(std)=	82.151	dscf
$Vm(std)m^3$=	2.326	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=	174.2	F
T=	633.8	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	
$SP_{H2O@Tsavg}$=	13.43	in. Hg
Ps=	29.52	in. Hg
Bws=	0.4550	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	16.899	scf
Vm(std)=	82.151	dscf
Bws=	0.1706	vol. fraction
Bws used=	0.1706	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.05	% dv
O2=	20.64	% dv
CO + N2=	79.30	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.05	% dv
O2=	20.64	% dv
CO + N2=	79.30	% dv
Md=	28.83	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.83	lb/lb-mole
Bws=	0.1706	vol. fraction
Ms=	26.99	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.52	in. Hg
Pg=	0.01	in. H2O
Ps=	29.52	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	
$(dP)^{1/2}avg$=	0.2810	in. H2O^1/2
Tsavg=	174.2	F
Ps=	29.52	in. Hg
Ms=	26.99	lb/lb-mole
Vs=	18.00	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	18.00	ft/s
As=	900.00	ft2
Qacfm=	972,268	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	972,268	acfm
Qacm/min=	27,532	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	972,268	acfm
Tstandard=	68	F
Tsavg=	174.2	F
Ps=	29.52	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	798,697	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	798,697	scfm
Qscm/min=	22,617	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	798,697	scfm
Bws=	0.1706	vol. fraction
Qdscfm=	662,434	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	662,434	dscfm
Qdscm/min=	18,758	dscm/min

Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.408	inches
An=	0.000908	ft2

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	174.2	F
Vm(std)=	82.151	dscf
Ps=	29.52	in. Hg
Vs=	18.00	ft/s
An=	0.000908	ft2
Theta=	120	minutes
Bws=	0.1706	vol. fraction
I=	102.50	%

18. Mercury Emission Concentration - Fraction 1B (mg/DSCM)

EC=(Emission mass 1B)/Vmstd/1000 (ug/mg)

Emission Mass=	0.054	ug
Vm(std)m^3=	2.326	dscm
EC=	2.32E-05	mg/dscm

Method 0010/23

ACCI SAMPLE CALCULATIONS
Semi-vols Test Results
ArcelorMittal
16-167
Monessen, PA
Quench Tower
Normal
Top of Quench Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,781.0	g	K1method 4	0.04706	scf/ml
Wi	3,136.3	g	K2method 4	0.04715	scf/g
Vm	163.921	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.006		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.14	in. Hg	Kp	85.49	
dHavg	2.73	in. H2O	p_a	0.0	0
Tm	75.4	F	π	3.141593	
O2	20.42	% dv	Ds (or L)	600.00	inches
CO2	0.06	% dv	Stack Width (W)	216.00	inches
Pg	0.01	in. H2O	Dn	0.476	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.278	in. H2O^1/2	Tsavg	176.7	F
F_d	0	dscf/MMBtu			
TEF Adjusted Total	5.60	ng	12378-PeCDD	0.5	TEF
Quench Duration	5.00	minutes/quench	Naphthalene mass	228.0	ug
Quench Frequency	3.30	quenches/hour			

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=	3,781.0	g
Wi=	3,136.3	g
Vwsg(std)=	30.398	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	30.398	scf
Vw(std)=	30.398	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=	163.921	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	163.921	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	163.921	dacf
$Vm(m^3)$=	4.642	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=	163.921	dacf
Yd=	1.0060	
Pbar=	29.14	in. Hg
dHavg=	2.73	in. H2O
Tm=	75.4	F
Vm(std)=	159.400	dscf

$Vm(std)m^3 = Vm(std) * (1\ m^3 / 35.3145\ cf)$

Vm(std)=	159.400	dscf
$Vm(std)m^3$=	4.514	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=	176.7	F
T=	636.4	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	
$SP_{H2O@Tsavg}$=	14.23	in. Hg
Ps=	29.14	in. Hg
Bws=	0.4885	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	30.398	scf
Vm(std)=	159.400	dscf
Bws=	0.1602	vol. fraction
Bws used=	0.1602	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.06	% dv
O2=	20.42	% dv
CO + N2=	79.52	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.06	% dv
O2=	20.42	% dv
CO + N2=	79.52	% dv
Md=	28.83	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.83	lb/lb-mole
Bws=	0.1602	vol. fraction
Ms=	27.09	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.14	in. Hg
Pg=	0.01	in. H2O
Ps=	29.14	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=	0.2775	in. H2O^1/2
Tsavg=	176.7	F
Ps=	29.14	in. Hg
Ms=	27.09	lb/lb-mole
Vs=	17.90	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	17.90	ft/s
As=	900.00	ft2
Qacfm=	966,435	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	966,435	acfm
Qacm/min=	27,367	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	966,435	acfm
Tstandard=	68	F
Tsavg=	176.7	F
Ps=	29.14	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	780,523	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	780,523	scfm
Qscm/min=	22,102	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	780,523	scfm
Bws=	0.1602	vol. fraction
Qdscfm=	655,517	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	655,517	dscfm
Qdscm/min=	18,562	dscm/min

Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2		
PI=	3.141593	
Dn=	0.476	inches
An=	0.001236	ft2

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))		
K4method5=	0.0945	
Tsavg=	176.7	F
Vm(std)=	159.400	dscf
Ps=	29.14	in. Hg
Vs=	17.90	ft/s
An=	0.001236	ft2
Theta=	180	minutes
Bws=	0.1602	vol. fraction
I=	98.4	%

1,2,3,7,8-Pentachlorodibenzo-p-Dioxin TEF Adjusted Amount

1,2,3,7,8-Pentachlorodibenzo-p-Dioxin Adj Amt = TEFcompound * Mass Detected * (1 ng / 1000 pg)		
TEF compound 1,2,3,7,8-PCDD =	0.5	TEF
Mass Detected =	5.60	Pg
PCDD/PCDF Adj Amt =	0.0028	ng

PCDD/PCDF Emission Concentration (ng/m3) [1,2,3,7,8-Pentachlorodibenzo-p-Dioxin]

ng/m^3 = PCDD/PCDF Total Mass Collected /Vm(std)$m^{3/1000\ ng/ug}$		
Total Adjusted Mass Collected =	0.0028	ng
Vm(std)m^3 =	4.514	dscm
ng/m^3	6.20E-07	ug/m^3

Naphthalene Emission Concentration (mg/m3)

mg/m3 = Sample Mass / Sample Volume / (1000 ug/mg)		
Naphthalene mass =	228	ug
Vm(std)m^3 =	4.514	dscm
Naphthalene conc. =	0.0505	mg/dscm

Methods 315

ACCI SAMPLE CALCULATIONS
Toluene Soluble Organics
ArcelorMittal
16-167
Monessen, PA
Quench Tower
Normal
Oct. 27, 2016
Top of Quench Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,293.7	g	K1method 4	0.04706	scf/ml
Wi	2,790.8	g	K2method 4	0.04715	scf/g
Vm	79.713	0.000	K1method 5	17.64	R/in. Hg
			K4method 5	0.0945	
Yd	0.9980		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.14	in. Hg	Kp	85.49	
dHavg	0.63	in. H2O			
Tm	70.8	F	π	3.141593	
O2	20.42	% dv	Ds (or L)	600.00	inches
CO2	0.06	% dv	Stack Width (W)	216.00	inches
Pg	0.01	in. H2O	Dn	0.337	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.276	in. H2O^1/2	Tsavg	178.8	F
F_d	NA	dscf/MMBtu	An	0.0006	ft2
			Quench Duration	5.0000	minutes/quench
			Quench Frequency	3.3000	quenches/hour

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=	3,293.7	g
Wi=	2,790.8	g
Vwsg(std)=	23.712	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	23.712	scf
Vw(std)=	23.712	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=	79.713	0.000
Volume metered in dry actual liters=	0.000	0.000
Vm=	79.713 dacf	

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	79.713	dacf
$Vm(m^3)$=	2.257	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=	79.713	dacf
Yd=	0.9980	
Pbar=	29.14	in. Hg
dHavg=	0.63	in. H2O
Tm=	70.8	F
Vm(std)=	77.159	dscf

$Vm(std)m^3 = Vm(std) * (1\ m^3 / 35.3145\ cf)$

Vm(std)=	77.159	dscf
$Vm(std)m^3$=	2.185	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=	178.8	F
T=	638.5	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	
$SP_{H2O@Tsavg}$=	14.92	in. Hg
Ps=	29.14	in. Hg
Bws=	0.5121	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	23.712	scf
Vm(std)=	77.159	dscf
Bws=	0.2351	vol. fraction
Bws used=	0.2351	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.06	% dv
O2=	20.42	% dv
CO + N2=	79.52	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.06	% dv
O2=	20.42	% dv
CO + N2=	79.52	% dv
Md=	28.83	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.83	lb/lb-mole
Bws=	0.2351	vol. fraction
Ms=	26.28	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.14	in. Hg
Pg=	0.01	in. H2O
Ps=	29.14	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=	0.2764	in. H2O^1/2
Tsavg=	178.8	F
Ps=	29.14	in. Hg
Ms=	26.28	lb/lb-mole
Vs=	18.13	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	18.13	ft/s
As=	900.00	ft2
Qacfm=	979,019	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	979,019	acfm
Qacm/min=	27,723	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	979,019	acfm
Tstandard=	68	F
Tsavg=	178.8	F
Ps=	29.14	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	788,074	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	788,074	scfm
Qscm/min=	22,316	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	788,074	scfm
Bws=	0.2351	vol. fraction
Qdscfm=	602,820	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	602,820	dscfm
Qdscm/min=	17,070	dscm/min

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	178.8	F
Vm(std)=	77.159	dscf
Ps=	29.14	in. Hg
Vs=	18.13	ft/s
An=	0.000619	ft2
Theta=	180	minutes
Bws=	0.2351	vol. fraction
I=	103.38	%

Total Weight of TSO

mnTSO = TSO Solvent wash weight gain + TSO filter weight gain

Front-half Filter TSO Mass (mn)	8.2 mg
F1/2 Rinse TSO Mass (mn)	8.3 mg
B1/2 TSO Mass (mn)	2.6 mg
B1/2 Rinse TSO Mass (mn)	6.5 mg
Blank Front-half Filter	9.3 mg
Blank F1/2 Rinse	5.5 mg
Blank Back Half Water	0.0 mg
Blank Back Half Toluene Rinse	2.4 mg
Blank Corrected Front Half Filter =	0.0 mg
Blank Corrected F1/2 Rinse =	2.8 mg
Blank Corrected Inorganic Mass =	2.6 mg
Blank Corrected Organic Mass =	4.1 mg
m_n=	9.5 mg

TSO Emission Concentration (mg/dscm)

TSO(gr/dscf) = mn / Vm(std)m3

m_n=	9.46	mg
Vm(std)=	2.18	dscm
TSO(gr/dscf)=	4.33	mg/dscm

Method 316

ACCI SAMPLE CALCULATIONS
Formaldehyde Test Results
ArcelorMittal Monessen
16-167
Monessen, PA
Quench Tower
Normal
Oct. 25, 2016
Top of Quench Tower
Run 1

Vf	0.0	0	Tstandard	68	F
Vi	0.0	0	Pstandard	760	mm Hg
Wf	2,995.5	ml	K1method 4	0.04706	scf/ml
Wi	2,812.5	ml	K2method 4	0.04715	scf/g
Vm	44.821	dacf	K1method 5	17.64	R/in. Hg
			K4method 5	0.0945	
Yd	0.9880		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.48	in. Hg	Kp	85.49	
dHavg	0.46	in. H2O			
Tm	65.1	F	π	3.141593	
O2	19.44	% dv	Ds (or L)	600.00	in. Hg
CO2	0.03	% dv	Stack Width (W)	216.00	in. H2O
Pg	0.10	in. H2O	Dn	0.300	inches
Cp	0.84		Time	120	in. H2O
$(dP)^{1/2}$avg	0.265	in. H2O^1/2	Tsavg	161.3	F
F_d	NA	dscf/MMBtu	An	0.0005	ft2
Quench Duration	5.0	minutes/quench			
Quench Frequency	3.30	quenches/hour			

Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04706 scf/ml	
Vf=	0.0	0.0
Vi=	0.0	0.0
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=	2,995.5 ml
Wi=	2,812.5 ml
Vwsg(std)=	8.628 scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000 scf
Vwsg(std)=	8.628 scf
Vw(std)=	8.628 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=		44.821 dacf	
Volume metered in dry actual liters=		0.000	0.000
Vm=	44.821 dacf		

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	44.821 dacf
$Vm(m^3)$=	1.269 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=	44.821	dacf
Yd=	0.9880	
Pbar=	29.48	in. Hg
dHavg=	0.46	in. H2O
Tm=	65.1	F
Vm(std)=	43.907	dscf

$Vm(std)m^3 = Vm(std) * (1\ m^3 / 35.3145\ cf)$

Vm(std)=	43.907	dscf
$Vm(std)m^3$=	1.243	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=	161.3	F
T=	621.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	9.98	in. Hg
Ps=	29.49	in. Hg
Bws=	0.3383	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	8.628	scf
Vm(std)=	43.907	dscf
Bws=	0.1642	vol. fraction
Bws used=	0.1642	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.03	% dv
O2=	19.44	% dv
CO + N2=	80.53	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.03	% dv
O2=	19.44	% dv
CO + N2=	80.53	% dv
Md=	28.78	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.78	lb/lb-mole
Bws=	0.1642	vol. fraction
Ms=	27.01	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.48	in. Hg
Pg=	0.10	in. H2O
Ps=	29.49	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=	0.2653	in. H2O^1/2
Tsavg=	161.3	F
Ps=	29.49	in. Hg
Ms=	27.01	lb/lb-mole
Vs=	16.83	ft/s

Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2		
PI=	3.141593	
Ds=	0.00	in. Hg
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2		
L=	600.00	in. Hg
W=	216.00	in. H2O
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60		
Vs=	16.83	ft/s
As=	900.00	ft2
Qacfm=	908,708	acfm
Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)		
Qacfm=	908,708	acfm
Qacm/min=	25,732	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)		
Qacfm=	908,708	acfm
Tstandard=	68	F
Tsavg=	161.3	F
Ps=	29.49	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	761,040	scfm
Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)		
Qscfm=	761,040	scfm
Qscm/min=	21,550	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	761,040	scfm
Bws=	0.1642	vol. fraction
Qdscfm=	636,047	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	636,047	dscfm
Qdscm/min=	18,011	dscm/min

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	161.3	F
Vm(std)=	43.907	dscf
Ps=	29.49	in. Hg
Vs=	16.83	ft/s
An=	0.000491	ft2
Theta=	120	in. H2O
Bws=	0.1642	vol. fraction
I=	105.53	%

Total Weight of TSO

mnTSO = (TSO Solvent wash weight gain + TSO filter weight gain) / (1000 ug/mg)

Acetone wash weight gain=	12.00	ug
Filter weight gain=	0.00	ug
m_n=	0.012	mg

TSO Emission Concentration (mg/dscm)

TSO(gr/dscf) = 0.001 * (mn / Vm(std)) * 15.43

m_n=	0.012	mg
Vm(std)=	1.24	dscm
TSO(gr/dscf)=	0.0097	mg/dscm

Method 0031

ACCI SAMPLE CALCULATIONS
Flow, Moisture, Select VOC's
ArcelorMittal Monessen
16-167
Monessen, PA
Quench Tower
Normal
Oct. 25, 2016
Top of Quench Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	0.0	g	K1method 4	0.04706	scf/ml
Wi	0.0	g	K2method 4	0.04715	scf/g
Vm	0.000	liters	K1method 5	17.64	R/in. Hg
Vm	0.000	0.000	K4method 5	0.0945	
Yd	0.9980		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.48	in. Hg	Kp	85.49	
dHavg	0.46	in. H2O	π	3.141593	
Tm	65.1	F	Ds (or L)	600.00	inches
O2	19.44	% dv	Stack Width (W)	216.00	inches
CO2	0.03	% dv	Tsavg	161.3	F
Pg	0.10	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.265	in. H2O^1/2	Bws	0.1629	vol. fraction

Method 0031 Lab Results					
Benzene MW	78.11	lb/lb-mole	Quench Duration	5.00	ninutes/quench
Sample Volume	0.0609	dscm	Quench Frequency	3.30	quenches/hour
Mass Collected	41.90	micrograms			

Water Vapor in the Gas Stream

Bws used=	0.1629	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.03	% dv
O2=	19.44	% dv
CO + N2=	80.53	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.03	% dv
O2=	19.44	% dv
CO + N2=	80.53	% dv
Md=	28.78	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.78	lb/lb-mole
Bws=	0.1629	vol. fraction
Ms=	27.03	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.48	in. Hg
Pg=	0.10	in. H2O
Ps=	29.49	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=	0.2653	in. H2O^1/2
Tsavg=	161.3	F
Ps=	29.49	in. Hg
Ms=	27.03	lb/lb-mole
Vs=	16.82	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	16.82	ft/s
As=	900.00	ft2
Qacfm=	908,458	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	908,458	acfm
Qacm/min=	25,725	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	908,458	acfm
Tstandard=	68	F
Tsavg=	161.3	F
Ps=	29.49	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	760,831	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	760,831	scfm
Qscm/min=	21,544	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	760,831	scfm
Bws=	0.1629	vol. fraction
Qdscfm=	636,920	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	636,920	dscfm
Qdscm/min=	18,036	dscm/min

VOST Sample Volume (DSCF)

Sample $Volume_{DSCF}$ = Sample Volume (in liters)/ 28.136847 liters/ft^3

VOST Sample Volume =	60.92	liters
VOST Sample $Volume_{DSCF}$ =	2.165	DSCF

Benzene emission concentration (mg/DSCM)

Benzene (mg/DSCM) = Mass Collected (mg) /1000 mg/ug / Sample Volume (liters) * 1000 (liters/m3)

Mass Collected=	41.90	ug
Sample Volume=	0.0609	dscm
Benzene (mg/DSCM) =	0.688	mg/DSCM

Methods 3A/6C/10/15

Montrose SAMPLE CALCULATIONS
Flow, Moisture, CEMS
ArcelorMittal
16-167
Monessen, PA
Qunech Tower
Normal Load
November 1, 2016
Top of Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,724.7	g	K1method 4	0.04706	scf/ml
Wi	3,157.6	g	K2method 4	0.04715	scf/g
Vm	166.006	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.30	in. Hg	Kp	85.49	
dHavg	2.58	in. H2O	π	3.141593	
Tm	73.1	F	Ds (or L)	600.00	inches
O2	20.77	% dv	Stack Width (W)	216.00	inches
CO2	0.07	% dv	Tsavg	178.4	F
Pg	0.01	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.280	in. H2O^1/2			

CEMS DATA

Sulfur Dioxide					
$Caverage_{SO2}$	3.65	ppmdv			
C_{0SO2}	1.00	ppmdv			
Cma_{SO2}	25.43	ppmdv			
Cm_{SO2}	24.30	ppmdv			
MW SO2	64.0	lb/lb-mole			
Carbon Monoxide			Carbon Dioxide		
$Caverage_{CO}$	92.8	ppmdv	$Caverage_{THC}$	709.10	ppmdv
C_{0CO}	0.4	ppmdv	MW Carbon Dioxide	44	lb/lb-mole
Cma_{CO}	246.7	ppmdv			
Cm_{CO}	248.4	ppmdv	quench Frequency	3.30	quenches/hour
MW CO	28.0	lb/lb-mole	quench Duration	5.00	minutes/quench
Cavg. H2S	0.5	ppmwv			
MW H2S	34.1	lb/lb-mole			

Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04706	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	3,724.7	g
Wi=	3,157.6	g
Vwsg(std)=	26.739	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	26.739	scf
Vw(std)=	26.739	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=	166.006	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	166.006	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	166.006	dacf
$Vm(m^3)$=	4.701	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=	166.006	dacf
Yd=	1.0060	
Pbar=	29.30	in. Hg
dHavg=	2.58	in. H2O
Tm=	73.1	F
Vm(std)=	162.949	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	162.949	dscf
$Vm(std)m^3$=	4.614	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=	178.4	F
T=	638.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	14.76	in. Hg
Ps=	29.30	in. Hg
Bws=	0.5038	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	26.739	scf
Vm(std)=	162.949	dscf
Bws=	0.1410	vol. fraction
Bws used=	0.1410	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.07	% dv
O2=	20.77	% dv
CO + N2=	79.16	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.07	% dv
O2=	20.77	% dv
CO + N2=	79.16	% dv
Md=	28.84	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.84	lb/lb-mole
Bws=	0.1410	vol. fraction
Ms=	27.31	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.30	in. Hg
Pg=	0.01	in. H2O
Ps=	29.30	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=	0.2798	in. H2O^1/2
Tsavg=	178.4	F
Ps=	29.30	in. Hg
Ms=	27.31	lb/lb-mole
Vs=	17.94	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	17.94	ft/s
As=	900.00	ft2
Qacfm=	968,900	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	968,900	acfm
Qacm/min=	27,436	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	968,900	acfm
Tstandard=	68	F
Tsavg=	178.4	F
Ps=	29.30	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	784,808	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	784,808	scfm
Qscm/min=	22,223	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	784,808	scfm
Bws=	0.1410	vol. fraction
Qdscfm=	674,180	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	674,180	dscfm
Qdscm/min=	19,091	dscm/min

Sulfur dioxide concentration (ppmdv)

$C_{SO2} = (Caverage_{SO2} - C_{0SO2}) * Cma_{SO2} / (Cm_{SO2} - C_{0SO2})$

$Caverage_{SO2}$=	3.65 ppmdv
C_{0SO2}=	1.00 ppmdv
Cma_{SO2}=	25.43 ppmdv
Cm_{SO2}=	24.30 ppmdv
C_{SO2}=	2.89 ppmdv

Carbon Monoxide concentration (ppmdv)

$C_{CO} = (Caverage_{CO} - C0_{CO}) * Cma_{CO} / (Cm_{CO} - C0_{CO})$

$Caverage_{CO}$=	92.77 ppmdv
$C0_{CO}$=	0.40 ppmdv
Cma_{CO}=	246.70 ppmdv
Cm_{CO}=	248.40 ppmdv
C_{CO}=	91.88 ppmdv

Hydrogen Sulfide Concentration (ppmdv)

$C_{H2S} = (C_{H2S}$ wet) / (1 -Bws)

C_{H2S} wet =	0.50 ppmwv
Bws =	0.14 vol. fraction
C_{H2S}=	0.58 ppmdv

Method 320

Montrose SAMPLE CALCULATIONS
Flow, Moisture, M320
ArcelorMittal
16-167
Monessen, PA
Quench Tower
Normal
Nov. 1, 2016
Top of Quench Tower
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,724.7	g	K1method 4	0.04706	scf/ml
Wi	3,157.6	g	K2method 4	0.04715	scf/g
Vm	166.006	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.30	in. Hg	Kp	85.49	
dHavg	2.58	in. H2O	π	3.141593	
Tm	73.1	F	Ds (or L)	600.00	inches
O2	20.80	% dv	Stack Width (W)	216.00	inches
CO2	0.17	% dv	Tsavg	178.4	F
Pg	0.01	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.280	in. H2O^1/2	Push Frequency	3.30	Quenches/hour
			Push Duration	5.00	minutes/Quench
CEMS DATA					
HCl			HF		
$Caverage_{HCl}$	-0.22	ppmwv	$Caverage_{HF}$	0.052	ppmwv
MW HCl	36.4609	lb/lb-mole	MW HF	20.010	lb/lb-mole
HCN					
$Caverage_{HCN}$	1.17	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=	3,724.7	g
Wi=	3,157.6	g
Vwsg(std)=	26.739	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	26.739	scf
Vw(std)=	26.739	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=	166.006	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	166.006	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	166.006	dacf
$Vm(m^3)$=	4.701	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=	166.006	dacf
Yd=	1.0060	
Pbar=	29.30	in. Hg
dHavg=	2.58	in. H2O
Tm=	73.1	F
Vm(std)=	162.949	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	162.949	dscf
$Vm(std)m^3$=	4.614	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=	178.4	F
T=	638.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	14.76	in. Hg
Ps=	29.30	in. Hg
Bws=	0.5038	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	26.739	scf
Vm(std)=	162.949	dscf
Bws=	0.1410	vol. fraction
Bws used=	0.1410	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	0.17	% dv
O2=	20.80	% dv
CO + N2=	79.02	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	0.17	% dv
O2=	20.80	% dv
CO + N2=	79.02	% dv
Md=	28.86	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	28.86	lb/lb-mole
Bws=	0.1410	vol. fraction
Ms=	27.33	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.30	in. Hg
Pg=	0.01	in. H2O
Ps=	29.30	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=	0.2798	in. H2O^1/2
Tsavg=	178.4	F
Ps=	29.30	in. Hg
Ms=	27.33	lb/lb-mole
Vs=	17.94	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=	0.00	inches
As=	0.00	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	600.00	inches
W=	216.00	inches
As=	900.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	17.94	ft/s
As=	900.00	ft2
Qacfm=	968,633	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	968,633	acfm
Qacm/min=	27,429	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	968,633	acfm
Tstandard=	68	F
Tsavg=	178.4	F
Ps=	29.30	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	784,592	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	784,592	scfm
Qscm/min=	22,217	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	784,592	scfm
Bws=	0.1410	vol. fraction
Qdscfm=	673,994	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	673,994	dscfm
Qdscm/min=	19,085	dscm/min

Hydrogen Flouride concentration (ppmdv)

CHF = (CHF wet) / (1 -Bws)		
CHF (raw, M320)=	0.0518	ppmwv
CHF (MDL by M320)=	0.0538	ppmwv
CHF (used)=	0.0538	ppmwv
CHF wet =	0.054	ppmwv
Bws =	0.1410	vol. fraction
CHF=	0.063	ppmdv

Hydrogen Flouride concentration (mg/dscm)

CHF (mg/dscm) = ppmv * MW / 22.405		
CHF (ppmdv) =	0.063	ppmdv
MW HF =	20.010	lb/lb-mole
CHF (md/dscm) =	0.056	mg/dscm

Hydrogen Cyanide concentration (ppmdv)

CHCN = (CHCN wet) / (1 -Bws)		
CHCN (raw, M320)=	1.17	ppmwv
CHCN (MDL by M320)=	0.34	ppmwv
CHCN (used)=	1.17	ppmwv
CHCN wet =	1.17	ppmwv
Bws =	0.1410	vol. fraction
CHCN=	1.36	ppmdv

REPORT - APPENDIX F

USEPA September 13, 2016 FAQs and Responses

Frequently Asked Questions (FAQs) and Responses for Coke Ovens Information Collection Request (ICR)
Questions #1 through #27 (new FAQs start at #27) –September 13, 2016

[FAQs and Responses Excerpt for #13, #17 and #26]

13. Can we just do three traverse points at the quench tower for testing?

Response: We understand the safety concerns associated with this testing, but the effort associated with collection at three points is not much different than a full traverse of the stack. However, because of the special difficulties and safety issues with quench towers, testing may include a **minimum of 12 traverse points** for **all** ~~circle~~ **types of** stacks ~~or 13 traverse points for rectangular stacks~~ **from each port**, as described in Method 1 (**see section 11.2**). Also, in instances when the quench towers do not meet the upstream/downstream flow disturbance requirements of Method 1, it is still acceptable to sample your quench towers in these circumstances. You will not be required to conduct alternative site selection procedure (Method 1, Section 11.5.1) since the flowrate may not be high enough to conduct these tests.

17. It seems like because the quench tower tests are not being done exactly by EPA method protocols, the test data will not be valid and, therefore, will not useful in developing an emission limit. Since this might be a big expense for my company, why should we do the testing if the data will not be able to be used for an emission limit?

Coke companies always have had have the choice of doing the quench tower testing exactly as the methods are written. However, EPA has been sensitive to industry concerns about safety and the difficulty of the tests, so we have allowed certain deviations that we believe are not "deal breakers" and would allow us to set emission limits, if needed, and to develop representative values to be used within the risk model. Minimally, the emissions data you collect will inform EPA of the ***nature*** of the quench tower emissions, which may be sufficient for our purposes.

In summary, the required quench tower methodology for the Coke ICR is as follows, with a choice available for all facilities:

(1) Perform all quench tower air testing according to prescribed EPA methods that include the following specifications: 24 (or 25) traverse points from each sample port according to EPA Method 1; isokinetic flow for particulate-related samples as per EPA Method 5; and sampling points sufficiently above the last baffle, or otherwise positioned between baffles, so that the air flow at the sampling points is not impacted by upstream obstructions (as per EPA Method 1); ***OR***

(2) Perform any quench tower tests with the following modifications for safety purposes: at least 12 traverse points from each sample port described in EPA Method 1; samples collected at locations where the sampling flowrate is as close as possible to the preferred isokinetic range in Method 5 and recording of percent isokinetic flow during the tests; and, in instances when the quench towers do not meet the upstream/downstream flow disturbance requirements of Method 1, you will not be required to conduct alternative site selection procedure (Method 1, Section 11.5.1) since the flowrate may not be high enough to conduct these tests.

The EPA is requesting quench tower testing to understand the ***nature*** of the air emissions as a minimum goal. And we are requesting both air emissions data and simultaneous quench water samples in order to fully understand the relationship between the characteristics of the quench water effluent and the quench tower air emissions (see **FAQ #16** above for clarification of the sampling location for the quench tower water tests). We

will develop an emissions value for risk modelling from these quench tower data that we believe best represents the quench tower emissions at all facilities that may be based on individual facility data, pooled estimates from some or all facilities, an overall industry average, or combinations of the above. If emissions limits need to be developed, any fluctuations due to non-optimum sampling conditions will be incorporated into the calculation of the emissions limit in the UPL equation that EPA uses to develop emission limits. We may not know if we need to set an emission limit until we run the risk assessment.

In addition, we have ways to interpolate and/or interpret test data when it is not obtained by standard procedures. For example, isokinetics outside the prescribed window in Method 5 is permitted within the method (with "Administrator approval", see Method 5, section 8.6) and can be corrected for moderate amount of non-isokinetics when it is needed, i.e., with PM-related constituents. [Note, sampling of gases does not need isokinetic flow.] If flow disturbances are experienced when sampling is performed between the baffles, as opposed to above the baffles, and also if reduced sampling points are used, there likely will be more fluctuation in the data rom run to run. These fluctuations will be accounted for by taking an overall test average and, if a standard is develop, by the UPL equation which uses statistical terms to incorporate run-to-run variability.

Finally, the air and water emissions data from the quench tower will enable EPA to fully evaluate an appropriate standard for such units, if needed, be it an air emissions standard, a work practice standard, revised water limits in the format currently in the rule, or substantiate (i.e., keep) the water limits currently in the rule.

26. We **expect to be testing a quench tower at one of the Coke facilities for the Coke Oven ICR. The quench tower has a dimension of approximately 50 feet (wide) x 18 feet (high). There currently does not exist any test ports or a test platform. A platform 10 feet wide x 50 feet long and 4 ports are being planned across the 50 foot length to allow traverse sampling across the 18 foot span. Because of these large spans and the difficulty in using test probes with glass or quartz liners over 10 feet in effective length we would like to propose testing <u>half way</u> across the 18 foot span using 10 foot effective test probes allowing us to use glass liners as many of the test methods require. We would still attempt to test at 12 sampling points up to the half way point of the 18 foot span. Testing from both sides of the quench tower to cover the 18 foot span would require the facility to build 2 platforms instead of one. Would we get approval to test half of the quench span? Note we will be testing from four (4) ports along the same side, with three (s) sample points from each port.**

Additional comment from another facility: A oversized (i.e., 25-foot) sampling probe with a glass liner and over sheath requiring at least 100 to 200 lbs. of force to hold it in place would be necessary to cross entire length of tower; in this scenario, the testing personnel would be exposed to a significant safety risk due to steam volume and stack size.

EPA Response: Yes, you may test **<u>half-way across the tower width from one side</u>** of the quench tower **<u>if you do not already have ports installed on opposite sides of your tower(s)</u>.** For quench towers with ports only on one side of the tower, you may sample all 12 traverse points through the port(s) on one side of the tower from the middle of the tower out to the tower wall. For a rectangular tower with four ports, you should test all four (4) ports using three (3) sample points, as per guidance table below, that are evenly spaced (on volume basis), unless one or more of the ports are not representative of the tower air flow due to upstream disturbances. In this case, omit the port(s) downstream from the disturbance and add a traverse point to the other ports, i.e., a 4 (port) x 3 (point) traverse becomes a 3 (port) x 4 (point) traverse.

However, any facility with **<u>ports on opposite sides of the tower already available</u>**, should continue to plan to do a 12-point traverse across the entire width of the tower, either by using one port for all 12 traverse sampling points across the entire width of tower **OR** by using the two opposite ports for two traverses with six traverse points each, from the middle of the tower out to each side wall of the tower (2 ports x 6 point traverse).

These new instructions should prevent any facility from having to use an over-sized probe length.

TABLE 1-1 CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of tranverse points layout	Matrix
9	3×3
12	4×3
16	4×4
20	5×4
25	5×5
30	6×5
36	6×6
42	7×6
49	7×7

END OF REPORT