

## **Results of the June 23-24, 2020 Mercury Emissions Tests Performed at the ArcelorMittal Minorca Mine Inc. Facility Located in Virginia, Minnesota**

Indurating Furnace Stack A	SV014
Indurating Furnace Stack B	SV015
Indurating Furnace Stack C	SV016
Indurating Furnace Stack D	SV017

***Agency Interest ID 699***

***Air Emissions Permit No. 13700062-003***

***Barr Project No. 23692044.20***

Prepared for  
ArcelorMittal Minorca Mine Inc.  
Virginia, Minnesota

August 2020



## Results of the June 23-24, 2020 Mercury Emissions Tests Performed at the ArcelorMittal Minorca Mine Inc. Facility Located in Virginia, Minnesota

Indurating Furnace Stack A	SV014
Indurating Furnace Stack B	SV015
Indurating Furnace Stack C	SV016
Indurating Furnace Stack D	SV017

***Agency Interest ID 699***

***Air Emissions Permit No. 13700062-003***

***Barr Project No. 23692044.20***

Prepared for  
ArcelorMittal Minorca Mine Inc.  
Virginia, Minnesota

August 2020

---

Results of the June 23-24, 2020 Mercury Emissions Tests Performed at  
the ArcelorMittal Minorca Mine Inc. Facility Located in Virginia,  
Minnesota,

August 2020

Contents

Executive Summary.....	1
1.0 Introduction .....	2
2.0 Results Summary.....	3
2.1 Indurating Furnace Stacks A-D (SV014-SV017) .....	3
2.2 Combined Hg Emissions - Indurating Furnace (EU026) .....	3
3.0 Process Description.....	4
4.0 Stack Testing Procedures and Methods.....	5

---

## List of Tables in Text

Table ES-1	Executive Summary Table 1 .....	1
Table 1-1	Emission Source Information.....	2
Table 4-1	EPA Method 1 Criteria.....	5

## List of Tables

Table 1	Mercury Test Results – Indurating Furnace Stack A (SV014)
Table 2	Mercury Test Results – Indurating Furnace Stack B (SV015)
Table 3	Mercury Test Results – Indurating Furnace Stack C (SV016)
Table 4	Mercury Test Results – Indurating Furnace Stack D (SV017)
Table 5	Total Mercury Test Results – Indurating Furnace Stacks A-D (SV014-017), (EU026)

## List of Figures

Figure 1	Test Port Locations – A and B Indurating Furnace Stacks (SV014) and (SV015)
Figure 2	Traverse Point Locations – A and B Indurating Furnace Stacks (SV014) and (SV015)
Figure 3	Test Port Locations – C and D Indurating Furnace Stacks (SV016) and (SV017)
Figure 4	Traverse Point Locations – C and D Indurating Furnace Stack (SV016) and (SV017)

## List of Appendices

Appendix A	Report Calculations and Nomenclature
Appendix B	Field Data Sheets
Appendix C	Laboratory Reports and Sample Chain of Custody
Appendix D	Calibration Data
Appendix E	Process Operating Data
Appendix F	Stack Test Plan
Appendix G	Project Participants and Contact Information



# Report Certifications

## Certification of Sampling Procedures:

I certify under penalty of law that the sampling procedures were performed in accordance with the approved test plan and that the data presented in this test report are, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.



7-29-2020

Michael J. Norstrom  
Air Quality Engineer  
Barr Engineering Co.

Date

## Certification of Analytical Procedures:

I certify under penalty of law that the analytical procedures were performed in accordance with the requirements of the test methods and that the data presented for use in the test report were, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.



7/29/2020

Michael J. Norstrom  
Air Quality Engineer  
Barr Engineering Co.

Date

## Certification of Test Report by Testing Company:

I certify under penalty of law that this test report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed sampling and analysis relating to the performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.



July 28, 2020

Tom Kuchinski  
Vice President  
Stack Testing Services Coordinator  
Barr Engineering Co.

Date

---

### Certification of Test Report by Owner or Operator of Emission Facility:

I certify under penalty of law that the information submitted in this test report accurately reflects the operating conditions at the emission facility during this performance test and describes the date and nature of all operational and maintenance activities that were performed on the process and control equipment during the month prior to the performance test. Based on my inquiry of the person or persons who performed the operational and maintenance activities, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.

  
\_\_\_\_\_  
Jaime Johnson  
Manager - Environmental  
ArcelorMittal Minorca Mine Inc.

  
\_\_\_\_\_  
Date

## Executive Summary

Barr Engineering Co. (Barr) performed mercury (Hg) emissions determinations on the indurating furnace (EU026) Stacks A-D (SV014-SV017) at ArcelorMittal Minorca Mine Inc. (ArcelorMittal) facility located in Virginia, Minnesota. Testing was completed June 23-24, 2020 to satisfy Minnesota Mercury rule - Minn. Rule 7019.3050(E)(5). A Summary of test results are presented in the Executive Summary Table.

Table ES-1      Executive Summary Table 1

Test Parameter EPA Methods 1-4, ASTM 6784	Average Test Results				Total
	Indurating Furnace Stack A	Indurating Furnace Stack B	Indurating Furnace Stack C	Indurating Furnace Stack D	Indurating Furnace Line
<b>Stack Vent ID</b>	SV014	SV015	SV016	SV017	EU026
<b>Test Dates</b>	6/23/20	6/24/20	6/23/20	6/24/20	--
Total Mercury Concentration, ug/dscm	1.4	1.8	2.7	4.4	--
Mercury Emissions Rate, lb/hr	0.000792	0.00102	0.00140	0.00253	0.00574

## 1.0 Introduction

Barr Engineering Co. (Barr) performed mercury (Hg) emissions determinations on the indurating furnace Stacks A-D (SV014-SV017) at ArcelorMittal Minorca Mine Inc. (ArcelorMittal) facility located in Virginia, Minnesota. Testing was completed on June 23-24, 2020 to satisfy Minnesota Mercury rule - Minn. Rule 7019.3050(E)(5).

A test plan was submitted May 7, 2020 to the Minnesota Pollution Control Agency (MPCA). The pretest meeting requirement was held between Andy Place of the MPCA and Jaime Johnson of ArcelorMittal via email as indicated in the Test Plan Approval. The test plan, test plan approval letter, and relevant correspondences are provided in Appendix F.

Michael Norstrem led the Barr test team. Jaime Johnson of ArcelorMittal provided test coordination with facility operations. The performance tests were not witnessed by a representative of the MPCA. A list of project participants is provided in Appendix G.

Each mercury test consisted of three 2-hour test runs as required by ASTM 6784 Ontario Hydro Method. Indurating Furnace Stack A (SV014) and Indurating Furnace Stack C (SV016) were tested simultaneously on June 23, 2020. Indurating Furnace Stack B (SV015) and Indurating Furnace Stack D (SV017) were tested simultaneously on June 24, 2020.

Process data was recorded during the testing following the parameters listed in the test plan. The process was operated at the conditions indicated in the test plan during all tests. Process operating data can be found in Appendix E.

A list of the permit source group with target process operating rate ranges and applicable rules are presented in the following table.

**Table 1-1 Emission Source Information**

Source	Emission Unit	Control Equipment	Plant ID	Stack Vent	Fired Pellet Rate (LTPH)	Applicable Rules
Indurating Furnace	EU026	CE014 CE015 CE016 CE017	Stack A 108DC01 Stack B 108DC02 Stack C 108DC03 Stack D 108DC04	SV014 SV015 SV016 SV017	> 340	Hg No applicable limit  MN Mercury Rule Minn. R. 7019.3050

---

## 2.0 Results Summary

### 2.1 Indurating Furnace Stacks A-D (SV014-SV017)

The results of the Hg emissions determinations for all four Indurating Furnace Stacks (SV014-SV017) performed June 23-24, 2020 are found in Tables 1-4 of the appendices and summarized in the Executive Summary Table.

### 2.2 Combined Hg Emissions - Indurating Furnace (EU026)

The combined mercury emission rate of the four stacks are provided in Table 5. The total Hg emission rate from the four indurating furnace stacks is 0.00574 pounds per hour (lb/hr).

The finished pellet production rate averaged 364 long tons per hour (LTPH) during the testing on Stacks A and C on June 23, 2020 and 361 LTPH during the testing on Stacks B and D on June 24, 2020.

There were no testing delays or process upsets indicated during the testing.

---

## 3.0 Process Description

ArcelorMittal mines taconite ore (magnetite) and produces iron pellets that are shipped to the company's blast furnace in Indiana. Wet scrubbers control the particulate matter emissions in the waste gases from the pellet indurating process.

Concentrate slurry flows to a storage tank where limestone is added to make flux pellets. The concentrate is dewatered by vacuum disk filters, mixed with bentonite and conveyed to balling disks. Green balls produced on the balling disks are transferred to a roll conveyor for additional removal of over and undersize material.

The green balls are distributed evenly across pallet cars, prior to entry into the pellet furnace. The pallet cars have a layer of fired pellets, called the hearth layer, on the bottom and sides of the car. The hearth layer acts as a buffer between the pallet car and the heat generated through the exothermic conversion of magnetite to hematite.

There is one natural gas fired furnace at ArcelorMittal's taconite plant. The straight grate furnace has several distinct zones. The first two stages are updraft and downdraft drying zones. The next zones are the preheat zone and firing zone. The temperature increases as the pellets pass through each zone reaching a peak in the firing zone. The pellets enter the after-firing zone, where the conversion of magnetite to hematite is completed. The last two zones are cooling zones that allow the pellets to be discharged at a temperature of around 120 degrees Fahrenheit.

Heated air discharged from the two cooling zones is recirculated to the drying, preheat and firing zones. Off-gases from the furnaces are vented primarily through two ducts, the hood exhaust that handles the drying and recirculated cooling gases, and the windbox exhaust, which handles the preheat, firing, and after-firing gases. The windbox exhaust flows through a multiclone, which protects the downstream fan, and then enters a common header shared with the hood exhaust stream. The exhaust gases are subsequently divided into four streams which lead to four venturi rod scrubbers and exhaust from individual stacks.

Process throughput data is located in Appendix E.

## 4.0 Stack Testing Procedures and Methods

Testing was performed from ports meeting EPA Method 1 criteria. The Method 1 criteria are listed in the table below. Sample port location and traverse point detail are provided in Figures 1-4.

Table 4-1 EPA Method 1 Criteria

Stack Vent Number	Distance to Upstream Disturbances (Diameters)	Distance to Downstream Disturbances (Diameters)	Number of Ports	Number of Points	Average Absolute Yaw Angle
SV014	8.2	3.5	4	12	2.0
SV015	8.2	3.5	4	12	1.0
SV016	8.1	3.5	4	12	2.0
SV017	8.1	3.5	4	12	1.3

Volumetric airflow determinations were performed in accordance with EPA Method 2 using an S-type Pitot tube and oil manometer. Airflows were determined in conjunction with the ASTM 6784 Ontario Hydro tests.

Stack gas oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) compositions of the indurating furnace stacks were determined by modified EPA Method 3A from integrated bag samples collected during the ASTM 6784 Ontario Hydro tests runs. The integrated bag samples were analyzed using a calibrated O<sub>2</sub>/CO<sub>2</sub> analyzer. Analysis results are located in Appendix B. Calibration gas certifications are located in Appendix D.

Stack gas moisture content was determined by the performance of EPA Method 4, in conjunction with the ASTM 6784 Ontario Hydro tests.

Mercury (Hg) concentrations and emission rates were determined in accordance with ASTM D6784-16 Ontario Hydro. All glassware and reagent preparation was completed at Barr laboratory facilities. Potassium permanganate sample reagents were prepared onsite daily. Sample recovery was completed within Barr's mobile laboratory trailer to minimize contamination. Mercury samples were analyzed by Element One of Wilmington, North Carolina. The average result of the sample analysis and duplicate analysis are used in the calculation of emissions. Fractions reported with a value of "<" or "non-detect" are included in the total sample mass. Sample analysis results and chain of custody for all samples are located in Appendix C.

The test methods referenced above are found in 40 CFR Part 60, Appendix A and ASTM.

## Tables



**TABLE 1**  
**MERCURY TEST RESULTS**  
 Indurating Furnace Stack A (SV014)

Parameter	Run 1	Run 2	Run 3	Average
Test Date	6/23/2020	6/23/2020	6/23/2020	---
Test Period	0808 - 1015	1035 - 1242	1311 - 1519	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, °F	119	120	123	121
Avg. Moisture Content, %V/V	11.3	11.3	11.0	11.2
Air Flow Rate				
acfm	195,000	195,000	193,000	194,000
scfm	168,000	167,000	165,000	167,000
dscfm	149,000	148,000	147,000	148,000
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO <sub>3</sub> )	0.011	0.014	0.016	0.014
Filter	0.015	0.051	0.085	0.050
Oxidized Mercury (KCl)	0.748	0.805	1.008	0.853
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	0.023	0.008	0.023	0.018
Elemental Mercury (KMnO <sub>4</sub> )	2.54	2.36	2.25	2.38
Total Mercury	3.33	3.23	3.38	3.31
Sample Volume				
acf	89.02	89.94	88.39	89.12
dscf	82.42	82.40	80.54	81.79
dscm	2.33	2.33	2.28	2.32
Isokinetic Variation, %	98.9	99.2	97.9	98.7
Mercury Concentrations, ug/dscm				
Particulate Hg	0.01	0.03	0.04	0.03
Oxidized Hg	0.32	0.34	0.44	0.37
Elemental Hg	1.1	1.0	1.0	1.0
Total Mercury	1.4	1.4	1.5	1.4
Mercury Emission Rate, lb/hr				
Particulate Hg	0.000006	0.000015	0.000024	0.000015
Oxidized Hg	0.000178	0.000191	0.000243	0.000204
Elemental Hg	0.000610	0.000562	0.000547	0.000573
Total Mercury	0.000795	0.000769	0.000814	0.000792
Process Rate - Finished Pellets, long tons/hr				
	364	363	364	364

**TABLE 2**  
**MERCURY TEST RESULTS**  
 Indurating Furnace Stack B (SV015)

Parameter	Run 1	Run 2	Run 3	Average
Test Date	6/24/2020	6/24/2020	6/24/2020	---
Test Period	0810 - 1016	1040 - 1245	1300 - 1506	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, °F	123	127	128	126
Avg. Moisture Content, %V/V	11.8	12.1	11.9	11.9
Air Flow Rate				
acfm	198,000	198,000	199,000	198,000
scfm	169,000	167,000	168,000	168,000
dscfm	149,000	147,000	148,000	148,000
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO <sub>3</sub> )	0.024	0.020	0.031	0.025
Filter	0.092	0.006	0.144	0.081
Oxidized Mercury (KCl)	1.15	1.03	0.950	1.04
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	0.012	0.015	0.013	0.013
Elemental Mercury (KMnO <sub>4</sub> )	3.22	3.14	3.04	3.13
Total Mercury	4.49	4.21	4.18	4.29
Sample Volume				
acf	90.59	89.20	91.58	90.46
dscf	83.70	81.45	82.96	82.70
dscm	2.37	2.31	2.35	2.34
Isokinetic Variation, %	100.5	98.7	99.9	99.7
Mercury Concentrations, ug/dscm				
Particulate Hg	0.05	0.01	0.07	0.04
Oxidized Hg	0.49	0.44	0.40	0.44
Elemental Hg	1.4	1.4	1.3	1.3
Total Mercury	1.9	1.8	1.8	1.8
Mercury Emission Rate, lb/hr				
Particulate Hg	0.000027	0.000006	0.000041	0.000025
Oxidized Hg	0.000270	0.000245	0.000224	0.000246
Elemental Hg	0.000758	0.000754	0.000721	0.000744
Total Mercury	0.00105	0.00101	0.00099	0.00102
Process Rate - Finished Pellets, long tons/hr				
	363	362	359	361

**TABLE 3**  
**MERCURY TEST RESULTS**  
 Indurating Furnace Stack C (SV016)

Parameter	Run 1	Run 2	Run 3	Average
Test Date	6/23/2020	6/23/2020	6/23/2020	---
Test Period	0808 - 1015	1035 - 1242	1311 - 1519	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, °F	122	123	122	122
Avg. Moisture Content, %V/V	12.9	13.1	13.0	13.0
Air Flow Rate				
acfm	185,000	182,000	182,000	183,000
scfm	158,000	155,000	155,000	156,000
dscfm	137,000	135,000	135,000	136,000
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO <sub>3</sub> )	< 0.01	< 0.01	0.018	0.013
Filter	0.306	< 0.005	< 0.005	0.105
Oxidized Mercury (KCl)	0.468	0.467	1.19	0.71
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	0.009	0.013	0.033	0.019
Elemental Mercury (KMnO <sub>4</sub> )	4.70	4.49	4.40	4.53
Total Mercury	5.49	4.99	5.64	5.37
Sample Volume				
acf	74.61	73.86	74.25	74.24
dscf	70.00	68.56	68.62	69.06
dscm	1.98	1.94	1.94	1.96
Isokinetic Variation, %	99.4	99.0	99.2	99.2
Mercury Concentrations, ug/dscm				
Particulate Hg	0.16	< 0.01	0.01	0.06
Oxidized Hg	0.24	0.24	0.61	0.36
Elemental Hg	2.4	2.3	2.3	2.3
Total Mercury	2.8	2.6	2.9	2.7
Mercury Emission Rate, lb/hr				
Particulate Hg	0.000082	< 0.000004	0.000006	0.000031
Oxidized Hg	0.00012	0.00012	0.00031	0.00018
Elemental Hg	0.00122	0.00117	0.00115	0.00118
Total Mercury	0.00142	0.00130	0.00147	0.00140
Process Rate - Finished Pellets, long tons/hr				
	364	363	364	364

**TABLE 4**  
**MERCURY TEST RESULTS**  
 Indurating Furnace Stack D (SV017)

Parameter	Run 1	Run 2	Run 3	Average
Test Date	6/24/2020	6/24/2020	6/24/2020	---
Test Period	0810 - 1016	1040 - 1245	1300 - 1506	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, °F	133	135	136	135
Avg. Moisture Content, %V/V	15.4	15.2	15.1	15.2
Air Flow Rate				
acfm	219,000	219,000	217,000	218,000
scfm	184,000	183,000	181,000	183,000
dscfm	156,000	155,000	153,000	155,000
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO <sub>3</sub> )	0.019	0.024	0.018	0.020
Filter	0.009	0.042	0.007	0.019
Oxidized Mercury (KCl)	1.50	1.33	1.69	1.51
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	0.048	0.032	0.031	0.037
Elemental Mercury (KMnO <sub>4</sub> )	8.83	7.99	7.94	8.25
Total Mercury	10.40	9.42	9.68	9.83
Sample Volume				
acf	86.57	85.28	85.20	85.68
dscf	81.14	79.06	78.29	79.50
dscm	2.30	2.24	2.22	2.25
Isokinetic Variation, %	101.8	99.3	99.5	100.2
Mercury Concentrations, ug/dscm				
Particulate Hg	0.01	0.03	0.01	0.02
Oxidized Hg	0.65	0.59	0.76	0.67
Elemental Hg	3.9	3.6	3.6	3.7
Total Mercury	4.5	4.2	4.4	4.4
Mercury Emission Rate, lb/hr				
Particulate Hg	0.00001	0.00002	0.00001	0.00001
Oxidized Hg	0.00038	0.00035	0.00044	0.00039
Elemental Hg	0.00225	0.00208	0.00207	0.00213
Total Mercury	0.00264	0.00245	0.00251	0.00253
Process Rate - Finished Pellets, long tons/hr				
	363	362	359	361

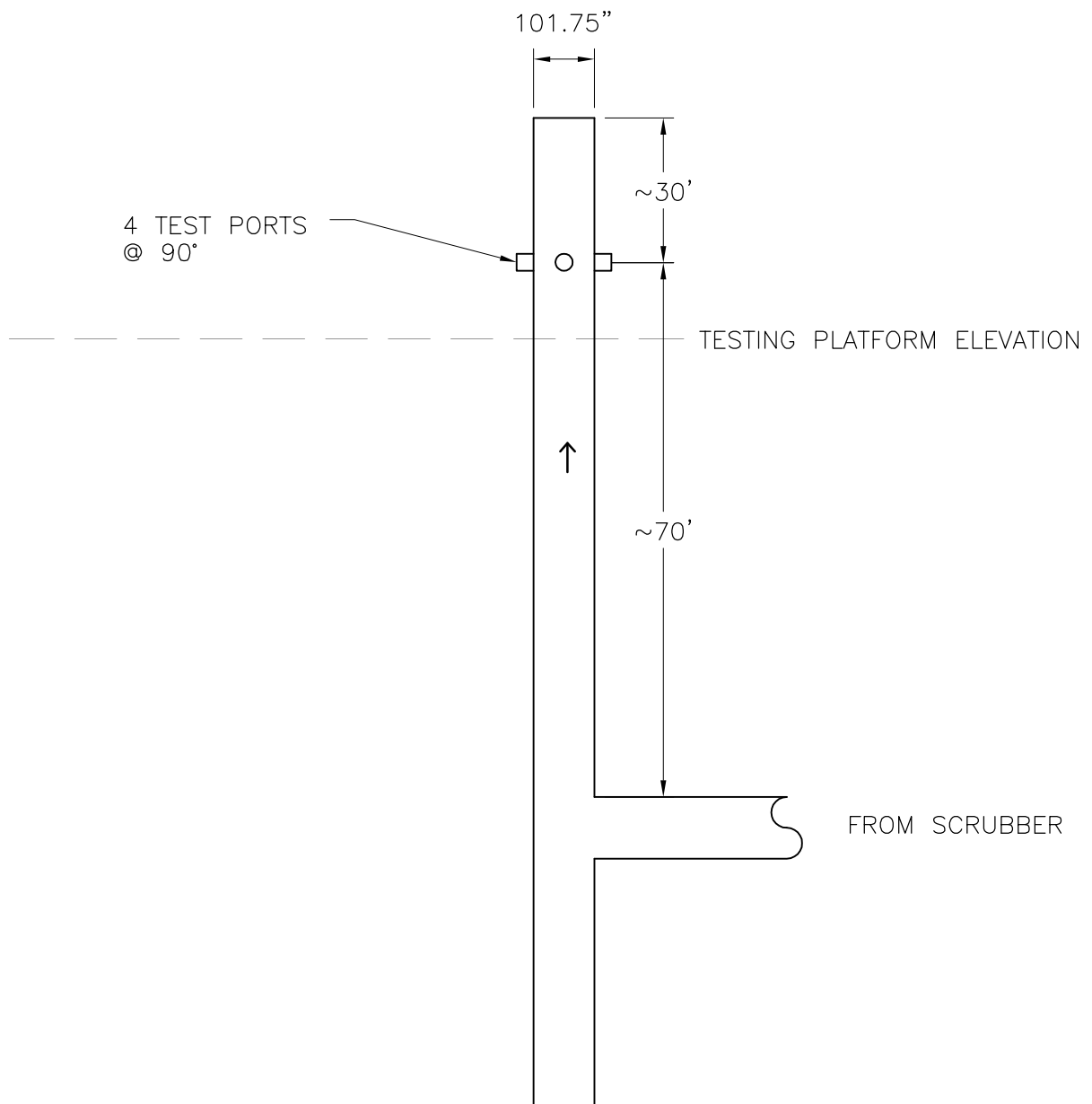
ArcelorMittal  
 Minorca Mine Inc.  
 Virginia, Minnesota

Barr Engineering Co.  
 July 30, 2020

**TABLE 5**  
**TOTAL MERCURY TEST RESULTS**  
 Indurating Furnace Stacks A-D (SV014-SV017), (EU 026)

Parameter	Stack A Test Average	Stack B Test Average	Stack C Test Average	Stack D Test Average	Average
Test Date	6/23/2020	6/24/2020	6/23/2020	6/24/2020	---
Test Period	0808 : 1519	0810 : 1506	0808 : 1519	0808 : 1519	---
Test Duration, min. (per run)	120	120	120	120	120
Avg. Stack Temperature, °F	121	126	122	135	126
Avg. Moisture Content, %V/V	11.2	11.9	13.0	15.2	12.8
Air Flow Rate					
acfm	194,000	198,000	183,000	218,000	793,000
scfm	167,000	168,000	156,000	183,000	674,000
dscfm	148,000	148,000	136,000	155,000	587,000
Mercury Emission Rate, lb/hr					
Particulate Hg	0.00002	0.00002	0.00003	0.00001	0.00008
Oxidized Hg	0.00020	0.00025	0.00018	0.00039	0.00102
Elemental Hg	0.00057	0.00074	0.00118	0.00213	0.00463
Total Mercury	0.00079	0.00102	0.00140	0.00253	0.00574
Process Rate - Finished Pellets, long tons/hr (A&C)	June 23, 2020	364			363
Process Rate - Finished Pellets, long tons/hr (B&D)	June 24, 2020	361			

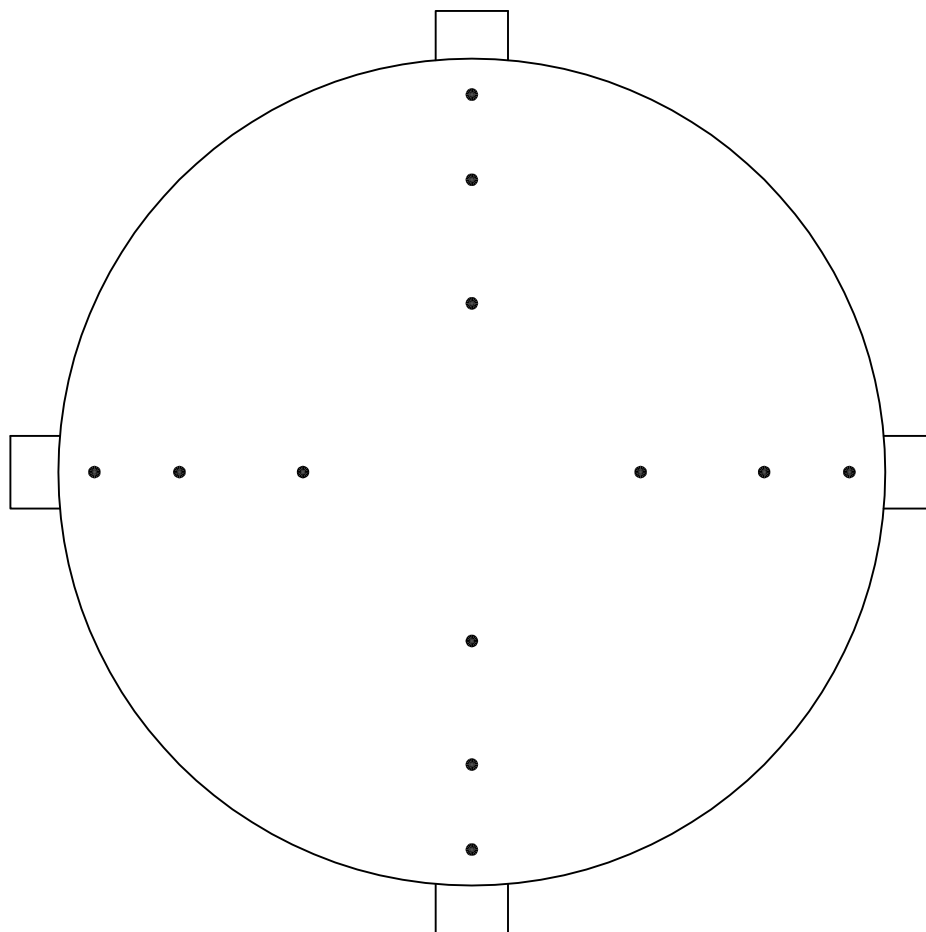
## Figures



TEST PORT LOCATIONS  
ARCELORMITTAL MINORCA MINE INC.  
VIRGINIA, MINNESOTA  
A & B INDURATING FURNACE STACKS (SV014) & (SV015)

NOT TO SCALE

FIGURE 1



NO. OF TEST PORTS	4
PORT LENGTH	4.5"
PORT DIAMETER	4.0"
NO. OF TRAVERSE POINTS	12
DUCT DIAMETER	101.75"

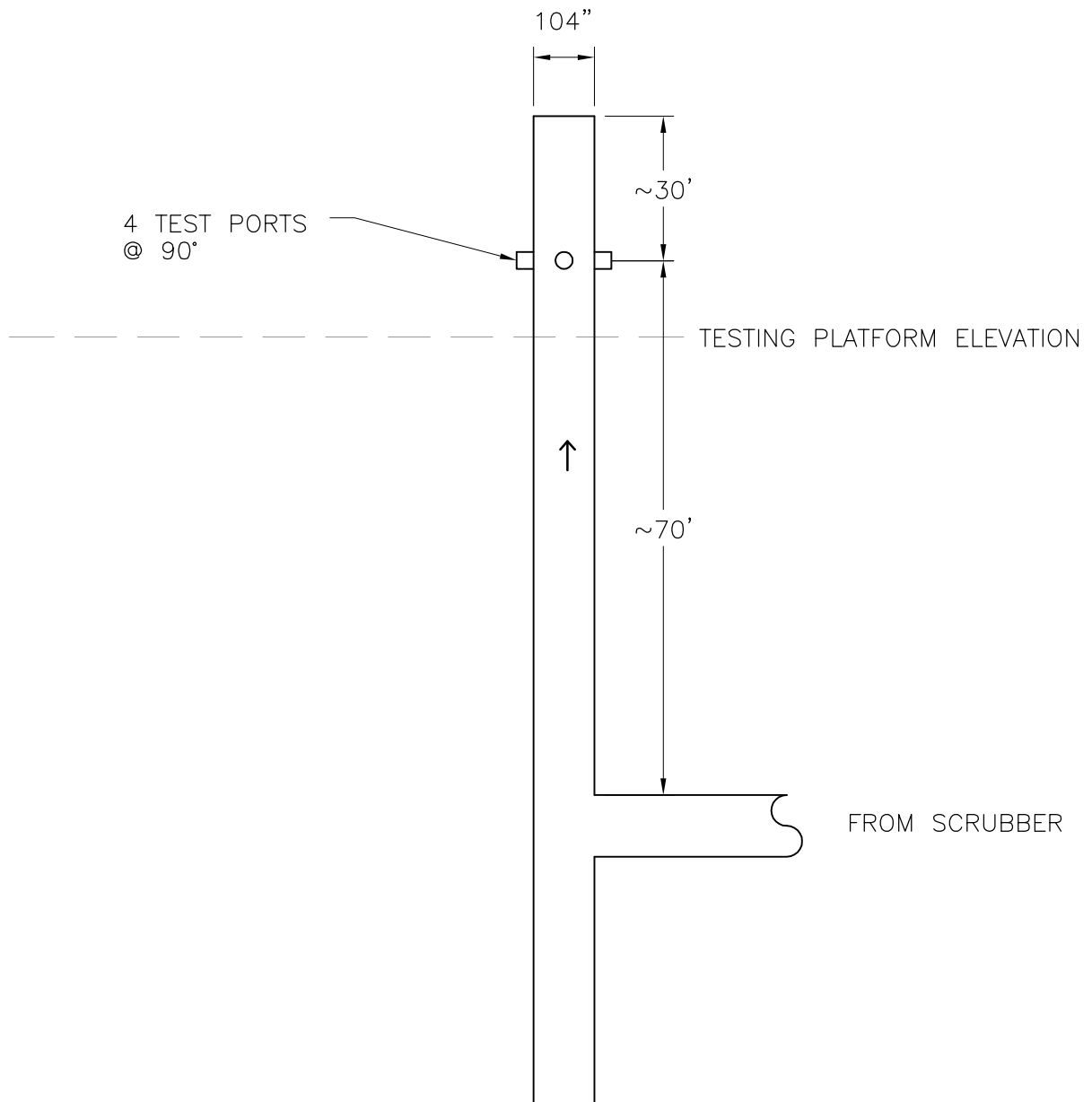
POINT	INSERTION DEPTH IN "
1	4.43
2	14.90
3	30.11

TRAVERSE POINT LOCATIONS  
ARCELORMITTAL MINORCA MINE INC.  
VIRGINIA, MINNESOTA  
A & B INDURATING FURNACE STACKS (SV014) & (SV015)

NOT TO SCALE

FIGURE 2

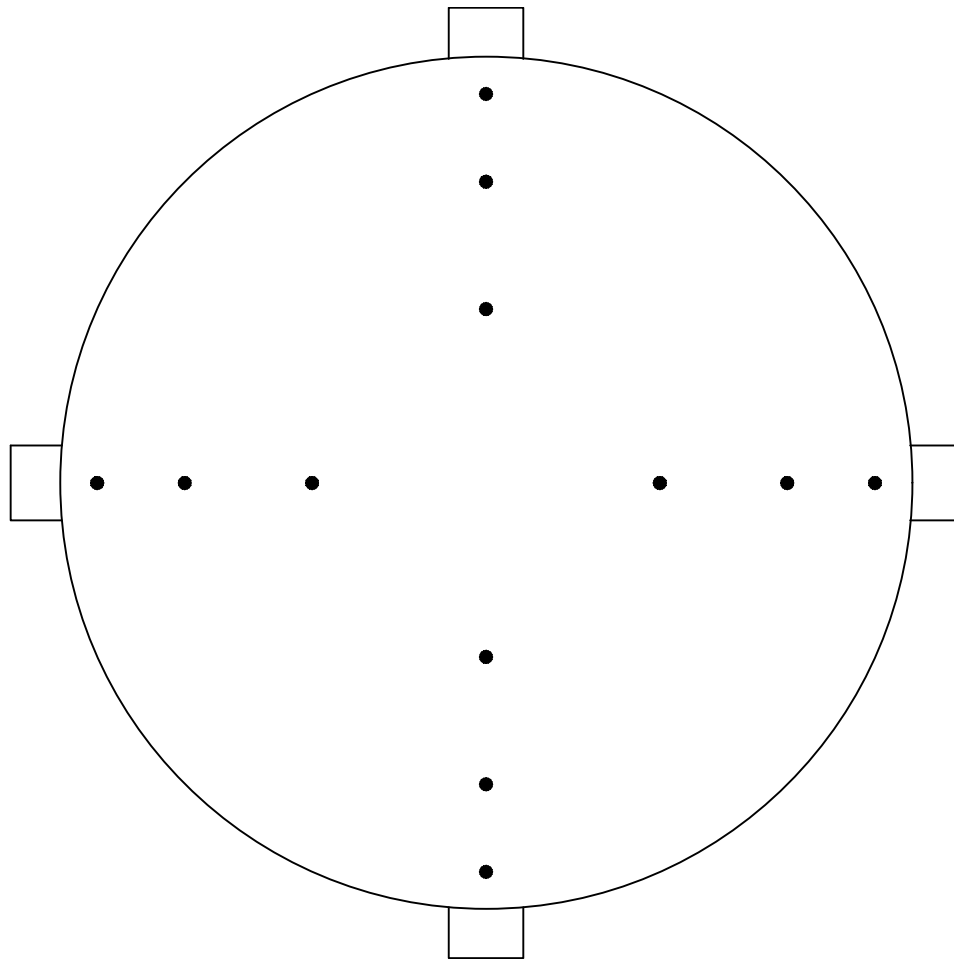




TEST PORT LOCATIONS  
ARCELORMITTAL MINORCA MINE, INC.  
VIRGINIA, MINNESOTA  
C & D INDURATING FURNACE STACKS (SV016) & (SV017)

NOT TO SCALE

FIGURE 3



NO. OF TEST PORTS	4
PORT LENGTH	<b>12.0"</b>
PORT DIAMETER	4.0"
NO. OF TRAVERSE POINTS	12
DUCT DIAMETER	104.00"

POINT	INSERTION DEPTH IN "
1	4.53
2	15.23
3	30.77

TRAVERSE POINT LOCATIONS  
ARCELORMITTAL MINORCA MINE, INC.  
VIRGINIA, MINNESOTA  
C & D INDURATING FURNACE STACKS (SV016) & (SV017)

NOT TO SCALE

FIGURE 4

## Appendices

## **Appendix A**

### **Report Calculations and Nomenclature**

Determination of Volumetric Air Flow Rate, Gas Composition, Moisture Content, Meter Volume and Isokinetic Sampling  
EPA Methods 2, 3, 4 and Isokinetics by Method  
Indurating Furnace Stack A (SV014)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/23/2020	6/23/2020	6/23/2020
Test Period	-	-	0808 - 1015	1035 - 1242	1311 - 1519
Number of Sample Ports	-	-	4	4	4
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	101.75	101.75	101.75
Barometric Pressure	Pbar	in. Hg	28.25	28.25	28.25
Stack Static Pressure	Pg	in. H <sub>2</sub> O	-0.90	-0.90	-0.90
Average Stack Temperature	Tsf	degrees F	119	120	123
Actual Dry Gas Meter Volume	Vm	cubic feet	89.02	89.94	88.39
Dry Gas Meter Calibration Factor	Y	-	0.9802	0.9802	0.9802
Average Orifice Meter Pressure Drop	DH	in H <sub>2</sub> O	1.57	1.60	1.57
Average Meter Temperature	Tmf	degrees F	70	75	78
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(DP) <sup>0.5</sup>	-	0.932	0.930	0.921
Mass of Water Vapor Condensed in Impingers	Vwc	g	200	199	191
Mass of Water Vapor Collected in Desiccant	Vwsg	g	22	23	21
Orsat Results, Dry Basis					
Oxygen	%O <sub>2</sub>	%v/v	19.8	19.8	19.8
Carbon Dioxide	%CO <sub>2</sub>	%v/v	1.3	1.3	1.3
Nitrogen + Carbon Monoxide	%N <sub>2</sub> + %CO	%v/v	78.9	78.9	78.9
Nozzle Diameter	Dn	inches	0.220	0.220	0.220
Run Time	theta	minutes	120	120	120
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature Tsr = Tsf + 460	Tsr	degrees R	579	580	583
Stack Pressure Ps = Pbar + Pg / 13.6	Ps	in. Hg	28.18	28.18	28.18
Duct Area A = PI x D <sup>2</sup> / (4 x 144) or A = L x W / 144	A	Sq. ft	56.467	56.467	56.467
Meter Volume at Standard Conditions Vmstd = 17.64 x Vm x Y x ((Pbar + (DH / 13.6)) / (Tmf + 460))	Vmstd-ft3	cubic feet	82.42	82.40	80.54
Meter Volume at Standard Conditions Vmstd-m3 = Vmstd-ft3 x 0.02832	Vmstd-m3	cubic meter	2.33	2.33	2.28
Average Moisture Content of Stack Gas MC = ((0.04175 x Vwc + 0.04715 x Vwsg) / ((0.04715 x Vwc + 0.04715 x Vwsg) + (Vmstd))) x 100	MC	% Vol	11.30	11.26	11.04
Molecular Weight of Stack Gas, dry Md = (0.44 x %CO <sub>2</sub> ) + (0.32 x %O <sub>2</sub> ) + (0.28 x (%N <sub>2</sub> + %CO))	Md	lb/lbmol	29.00	29.00	29.00
Molecular Weight of Stack Gas, wet Ms = Md x (1-(MC/100))+18 x (MC/100)	Ms	lb/lbmol	27.76	27.76	27.79
Average Stack Gas Velocity Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )	Vs	ft/sec	57.56	57.51	57.08
Actual Volumetric Air Flow Rate Qa = 60 x Vs x A	Qa	acfm	195,022	194,846	193,386
Volumetric Air Flow Rate at Standard Conditions Qs = Qa x (528 / (Ts + 460)) x (Ps / 29.92)	Qs	scfm	167,548	167,000	164,920
Dry Volumetric Air Flow Rate at Standard Conditions Qd = Qa x (1 - (MC / 100)) x (528 / Tsr) x (Ps / 29.92)	Qd	dscfm	148,615	148,193	146,711
Nozzle Cross-Sectional Area An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)	An	sq. ft	0.000264	0.000264	0.000264
Isokinetic Variation I = (0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1 - (MC / 100)))	I	%	98.9	99.2	97.9

Determination of Speciated Mercury Concentration and Emissions by Ontario Hydro Method  
ASTM Method D6784 Ontario-Hydro

Indurating Furnace Stack A (SV014)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/23/2020	6/23/2020	6/23/2020
Test Period	-	-	0808 - 1015	1035 - 1242	1311 - 1519
Run Time	theta	min	120	120	120
Meter Volume at Standard Conditions Vmstd	Vmstd-ft3	cubic feet	82.42	82.40	80.54
Meter Volume at Standard Conditions Vmstd	Vmstd-m3	cubic meter	2.33	2.33	2.28
Dry Volumetric Air Flow Rate at Standard Conditions (M2,M4, ISO Calcs)	Qd	DSCFM	148,615	148,193	146,711
Ontario Hydro Mercury Analytical Results					
Probe Rinse (0.1 N HNO <sub>3</sub> )	Hg <sub>pr</sub>	ug	0.011	0.014	0.016
Filter	Hg <sub>filter</sub>	ug	0.015	0.051	0.085
Oxidized Mercury (KCl)	Hg <sub>KCl</sub>	ug	0.748	0.805	1.008
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	Hg <sub>H2O2</sub>	ug	0.023	0.008	0.023
Elemental Mercury (KMnO <sub>4</sub> )	Hg <sub>KMnO4</sub>	ug	2.54	2.36	2.25
Total Mercury	Hg <sub>(total)</sub>	ug	3.33	3.23	3.38
Calculated Data					
Mercury Concentrations	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: $Hg^{tp} = (Hg_{pr} + Hg_{filter}) / Vmstd\text{-}m3$	Hg <sup>tp</sup>	ug/dscm	0.011	0.027	0.044
Oxidized Hg: $Hg^O = Hg_{KCl} / Vmstd\text{-}m3$	Hg <sup>O</sup>	ug/dscm	0.320	0.345	0.442
Elemental Hg: $Hg^E = (Hg_{H2O2} + Hg_{KMnO4}) / Vmstd\text{-}m3$	Hg <sup>E</sup>	ug/dscm	1.096	1.012	0.995
Total Hg: $Hg^{tot} = Hg_{(total)} / Vmstd\text{-}m3$	Hg <sup>tot</sup>	ug/dscm	1.427	1.385	1.481
Mercury Emission Rates	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: $E\text{-}Hg^{tp} = (Hg_{pr} + Hg_{filter}) \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>tp</sup>	lb/hr	0.0000061	0.0000152	0.0000243
Oxidized Hg: $E\text{-}Hg^O = Hg_{KCl} \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>O</sup>	lb/hr	0.0001783	0.0001915	0.0002428
Elemental Hg: $E\text{-}Hg^E = (Hg_{H2O2} + Hg_{KMnO4}) \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>E</sup>	lb/hr	0.0006102	0.0005621	0.0005466
Total Hg: $E\text{-}Hg^{tot} = Hg_{(total)} \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>tot</sup>	lb/hr	0.0007945	0.0007688	0.0008137

Determination of Volumetric Air Flow Rate, Gas Composition, Moisture Content, Meter Volume and Isokinetic Sampling  
 EPA Methods 2, 3, 4 and Isokinetics by Method  
 Indurating Furnace Stack B (SV015)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/24/2020	6/24/2020	6/24/2020
Test Period	-	-	0810 - 1016	1040 - 1245	1300 - 1506
Number of Sample Ports	-	-	4	4	4
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	101.75	101.75	101.75
Barometric Pressure	Pbar	in. Hg	28.23	28.23	28.23
Stack Static Pressure	Pg	in. H <sub>2</sub> O	-0.93	-0.93	-0.93
Average Stack Temperature	Tsf	degrees F	123	127	128
Actual Dry Gas Meter Volume	Vm	cubic feet	90.59	89.20	91.58
Dry Gas Meter Calibration Factor	Y	-	0.9802	0.9802	0.9802
Average Orifice Meter Pressure Drop	DH	in H <sub>2</sub> O	1.62	1.59	1.62
Average Meter Temperature	Tmf	degrees F	71	77	81
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(DP) <sup>0.5</sup>	-	0.941	0.937	0.943
Mass of Water Vapor Condensed in Impingers	Vwc	g	215	213	210
Mass of Water Vapor Collected in Desiccant	Vwsg	g	24	24	27
Orsat Results, Dry Basis					
Oxygen	%O <sub>2</sub>	%v/v	19.0	19.0	19.0
Carbon Dioxide	%CO <sub>2</sub>	%v/v	1.9	1.9	1.9
Nitrogen + Carbon Monoxide	%N <sub>2</sub> + %CO	%v/v	79.1	79.1	79.1
Nozzle Diameter	Dn	inches	0.220	0.220	0.220
Run Time	theta	minutes	120	120	120
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature Tsr = Tsf + 460	Tsr	degrees R	583	587	588
Stack Pressure Ps = Pbar + Pg / 13.6	Ps	in. Hg	28.16	28.16	28.16
Duct Area A = PI x D <sup>2</sup> / (4 x 144) or A = L x W / 144	A	Sq. ft	56.467	56.467	56.467
Meter Volume at Standard Conditions Vmstd = 17.64 x Vm x Y x ((Pbar + (DH / 13.6)) / (Tmf + 460))	Vmstd-ft3	cubic feet	83.70	81.45	82.96
Meter Volume at Standard Conditions Vmstd-m3 = Vmstd-ft3 x 0.02832	Vmstd-m3	cubic meter	2.37	2.31	2.35
Average Moisture Content of Stack Gas MC = ((0.04175 x Vwc + 0.04715 x Vwsg) / ((0.04715 x Vwc + 0.04715 x Vwsg) + (Vmstd)) x 100	MC	% Vol	11.84	12.06	11.88
Molecular Weight of Stack Gas, dry Md = (0.44 x %CO <sub>2</sub> ) + (0.32 x %O <sub>2</sub> ) + (0.28 x (%N <sub>2</sub> + %CO))	Md	lb/lbmol	29.06	29.06	29.06
Molecular Weight of Stack Gas, wet Ms = Md x (1 - (MC/100)) + 18 x (MC/100)	Ms	lb/lbmol	27.75	27.73	27.75
Average Stack Gas Velocity Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )	Vs	ft/sec	58.31	58.31	58.72
Actual Volumetric Air Flow Rate Qa = 60 x Vs x A	Qa	acfm	197,560	197,563	198,956
Volumetric Air Flow Rate at Standard Conditions Qs = Qa x (528 / (Ts + 460)) x (Ps / 29.92)	Qs	scfm	168,539	167,381	168,155
Dry Volumetric Air Flow Rate at Standard Conditions Qd = Qa x (1 - (MC / 100)) x (528 / Tsr) x (Ps / 29.92)	Qd	dscfm	148,577	147,195	148,171
Nozzle Cross-Sectional Area An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)	An	sq. ft	0.000264	0.000264	0.000264
Isokinetic Variation I = (0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1 - (MC / 100)))	I	%	100.5	98.7	99.9

Determination of Speciated Mercury Concentration and Emissions by Ontario Hydro Method  
ASTM Method D6784 Ontario-Hydro

Indurating Furnace Stack B (SV015)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/24/2020	6/24/2020	6/24/2020
Test Period	-	-	0810 - 1016	1040 - 1245	1300 - 1506
Run Time	theta	min	120	120	120
Meter Volume at Standard Conditions Vmstd	Vmstd-ft3	cubic feet	83.70	81.45	82.96
Meter Volume at Standard Conditions Vmstd	Vmstd-m3	cubic meter	2.37	2.31	2.35
Dry Volumetric Air Flow Rate at Standard Conditions (M2,M4, ISO Calcs)	Qd	DSCFM	148,577	147,195	148,171
Ontario Hydro Mercury Analytical Results					
Probe Rinse (0.1 N HNO <sub>3</sub> )	Hg <sub>pr</sub>	ug	0.024	0.020	0.031
Filter	Hg <sub>filter</sub>	ug	0.092	0.006	0.144
Oxidized Mercury (KCl)	Hg <sub>KCl</sub>	ug	1.15	1.03	0.950
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	Hg <sub>H2O2</sub>	ug	0.012	0.015	0.013
Elemental Mercury (KMnO <sub>4</sub> )	Hg <sub>KMnO4</sub>	ug	3.22	3.14	3.04
Total Mercury	Hg <sub>(total)</sub>	ug	4.49	4.21	4.18
Calculated Data					
Mercury Concentrations	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: $Hg^{tp} = (Hg_{pr} + Hg_{filter}) / Vmstd\text{-}m3$	Hg <sup>tp</sup>	ug/dscm	0.049	0.011	0.074
Oxidized Hg: $Hg^O = Hg_{KCl} / Vmstd\text{-}m3$	Hg <sup>O</sup>	ug/dscm	0.485	0.444	0.404
Elemental Hg: $Hg^E = (Hg_{H2O2} + Hg_{KMnO4}) / Vmstd\text{-}m3$	Hg <sup>E</sup>	ug/dscm	1.362	1.368	1.299
Total Hg: $Hg^{tot} = Hg_{(total)} / Vmstd\text{-}m3$	Hg <sup>tot</sup>	ug/dscm	1.895	1.824	1.778
Mercury Emission Rates	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: $E\text{-}Hg^{tp} = (Hg_{pr} + Hg_{filter}) \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>tp</sup>	lb/hr	0.000027	0.000006	0.000041
Oxidized Hg: $E\text{-}Hg^O = Hg_{KCl} \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>O</sup>	lb/hr	0.000270	0.000245	0.000224
Elemental Hg: $E\text{-}Hg^E = (Hg_{H2O2} + Hg_{KMnO4}) \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>E</sup>	lb/hr	0.000758	0.000754	0.000721
Total Hg: $E\text{-}Hg^{tot} = Hg_{(total)} \times 2.2046 \times 10^{-9} / Vstd\text{-}ft3 \times 60 \times dscfm$	E-Hg <sup>tot</sup>	lb/hr	0.001055	0.001006	0.000987



Determination of Volumetric Air Flow Rate, Gas Composition, Moisture Content, Meter Volume and Isokinetic Sampling  
EPA Methods 2, 3, 4 and Isokinetics by Method  
Indurating Furnace Stack C (SV016)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/23/2020	6/23/2020	6/23/2020
Test Period	-	-	0808 - 1015	1035 - 1242	1311 - 1519
Number of Sample Ports	-	-	4	4	4
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	104.00	104.00	104.00
Barometric Pressure	Pbar	in. Hg	28.25	28.25	28.25
Stack Static Pressure	Pg	in. H <sub>2</sub> O	-0.90	-0.90	-0.90
Average Stack Temperature	Tsf	degrees F	122	123	122
Actual Dry Gas Meter Volume	Vm	cubic feet	74.61	73.86	74.25
Dry Gas Meter Calibration Factor	Y	-	0.9831	0.9831	0.9831
Average Orifice Meter Pressure Drop	DH	in H <sub>2</sub> O	1.32	1.29	1.29
Average Meter Temperature	Tmf	degrees F	64	70	72
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(DP) <sup>0.5</sup>	-	0.840	0.829	0.826
Mass of Water Vapor Condensed in Impingers	Vwc	g	213	217	206
Mass of Water Vapor Collected in Desiccant	Vwsg	g	18	18	20
Orsat Results, Dry Basis					
Oxygen	%O <sub>2</sub>	%v/v	18.7	18.7	18.7
Carbon Dioxide	%CO <sub>2</sub>	%v/v	2.2	2.2	2.2
Nitrogen + Carbon Monoxide	%N <sub>2</sub> + %CO	%v/v	79.1	79.1	79.1
Nozzle Diameter	Dn	inches	0.215	0.215	0.215
Run Time	theta	minutes	120	120	120
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature Tsr = Tsf + 460	Tsr	degrees R	582	583	582
Stack Pressure Ps = Pbar + Pg / 13.6	Ps	in. Hg	28.18	28.18	28.18
Duct Area A = Pl x D <sup>2</sup> / (4 x 144) or A = L x W / 144	A	Sq. ft	58.992	58.992	58.992
Meter Volume at Standard Conditions Vmstd = 17.64 x Vm x Y x ((Pbar + (DH / 13.6)) / (Tmf + 460))	Vmstd-ft3	cubic feet	70.00	68.56	68.62
Meter Volume at Standard Conditions Vmstd-m3 = Vmstd-ft3 x 0.02832	Vmstd-m3	cubic meter	1.98	1.94	1.94
Average Moisture Content of Stack Gas MC = ((0.04175 x Vwc + 0.04715 x Vwsg) / ((0.04715 x Vwc + 0.04715 x Vwsg) + (Vmstd))) x 100	MC	% Vol	12.89 see note	13.05 see note	12.98 see note
Molecular Weight of Stack Gas, dry Md = (0.44 x %CO <sub>2</sub> ) + (0.32 x %O <sub>2</sub> ) + (0.28 x (%N <sub>2</sub> + %CO))	Md	lb/lbmol	29.10	29.10	29.10
Molecular Weight of Stack Gas, wet Ms = Md x (1 - (MC/100)) + 18 x (MC/100)	Ms	lb/lbmol	27.67	27.65	27.66
Average Stack Gas Velocity Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )	Vs	ft/sec	52.14	51.45	51.30
Actual Volumetric Air Flow Rate Qa = 60 x Vs x A	Qa	acfm	184,561	182,117	181,564
Volumetric Air Flow Rate at Standard Conditions Qs = Qa x (528 / (Ts + 460)) x (Ps / 29.92)	Qs	scfm	157,710	155,499	155,082
Dry Volumetric Air Flow Rate at Standard Conditions Qd = Qa x (1 - (MC / 100)) x (528 / Tsr) x (Ps / 29.92)	Qd	dscfm	137,385	135,204	134,957
Nozzle Cross-Sectional Area An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)	An	sq. ft	0.000252	0.000252	0.000252
Isokinetic Variation I = (0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1 - (MC / 100)))	I	%	99.4	99.0	99.2

Note: Moisture Content limited to moisture at saturation

Determination of Speciated Mercury Concentration and Emissions by Ontario Hydro Method  
ASTM Method D6784 Ontario-Hydro

Indurating Furnace Stack C (SV016)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/23/2020	6/23/2020	6/23/2020
Test Period	-	-	0808 - 1015	1035 - 1242	1311 - 1519
Run Time	theta	min	120	120	120
Meter Volume at Standard Conditions Vmstd	Vmstd-ft3	cubic feet	70.00	68.56	68.62
Meter Volume at Standard Conditions Vmstd	Vmstd-m3	cubic meter	1.98	1.94	1.94
Dry Volumetric Air Flow Rate at Standard Conditions (M2,M4, ISO Calcs)	Qd	DSCFM	137,385	135,204	134,957
Ontario Hydro Mercury Analytical Results					
Probe Rinse (0.1 N HNO <sub>3</sub> )	Hg <sub>pr</sub>	ug	< 0.01	< 0.01	0.018
Filter	Hg <sub>filter</sub>	ug	0.306	< 0.005	< 0.005
Oxidized Mercury (KCl)	Hg <sub>KCl</sub>	ug	0.468	0.467	1.19
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	Hg <sub>H2O2</sub>	ug	0.009	0.013	0.033
Elemental Mercury (KMnO <sub>4</sub> )	Hg <sub>KMnO4</sub>	ug	4.70	4.49	4.40
Total Mercury	Hg <sub>(total)</sub>	ug	5.49	4.99	5.64
Calculated Data					
Mercury Concentrations	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: Hg <sup>tp</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) / Vmstd-m3	Hg <sup>tp</sup>	ug/dscm	0.159	< 0.008	0.012
Oxidized Hg: Hg <sup>O</sup> = Hg <sub>KCl</sub> / Vmstd-m3	Hg <sup>O</sup>	ug/dscm	0.236	0.241	0.612
Elemental Hg: Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) / Vmstd-m3	Hg <sup>E</sup>	ug/dscm	2.373	2.319	2.279
Total Hg: Hg <sup>tot</sup> = Hg <sub>(total)</sub> / Vmstd-m3	Hg <sup>tot</sup>	ug/dscm	2.768	2.568	2.903
Mercury Emission Rates	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: E-Hg <sup>tp</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>tp</sup>	lb/hr	0.000082	< 0.000004	0.000006
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>O</sup>	lb/hr	0.000121	0.000122	0.000310
Elemental Hg: E-Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>E</sup>	lb/hr	0.001221	0.001175	0.001152
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>tot</sup>	lb/hr	0.001425	0.001300	0.001468

Determination of Volumetric Air Flow Rate, Gas Composition, Moisture Content, Meter Volume and Isokinetic Sampling  
 EPA Methods 2, 3, 4 and Isokinetics by Method  
 Indurating Furnace Stack D (SV017)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/24/2020	6/24/2020	6/24/2020
Test Period	-	-	0810 - 1016	1040 - 1245	1300 - 1506
Number of Sample Ports	-	-	4	4	4
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	104.00	104.00	104.00
Barometric Pressure	Pbar	in. Hg	28.23	28.23	28.23
Stack Static Pressure	Pg	in. H <sub>2</sub> O	-0.94	-0.94	-0.94
Average Stack Temperature	Tsf	degrees F	133	135	136
Actual Dry Gas Meter Volume	Vm	cubic feet	86.57	85.28	85.20
Dry Gas Meter Calibration Factor	Y	-	0.9831	0.9831	0.9831
Average Orifice Meter Pressure Drop	DH	in H <sub>2</sub> O	1.77	1.71	1.69
Average Meter Temperature	Tmf	degrees F	65	70	75
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(DP) <sup>0.5</sup>	-	0.985	0.983	0.972
Mass of Water Vapor Condensed in Impingers	Vwc	g	289	278	272
Mass of Water Vapor Collected in Desiccant	Vwsg	g	24	22	25
Orsat Results, Dry Basis					
Oxygen	%O <sub>2</sub>	%v/v	18.3	18.3	18.3
Carbon Dioxide	%CO <sub>2</sub>	%v/v	2.6	2.6	2.6
Nitrogen + Carbon Monoxide	%N <sub>2</sub> + %CO	%v/v	79.1	79.1	79.1
Nozzle Diameter	Dn	inches	0.215	0.215	0.215
Run Time	theta	minutes	120	120	120
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature Tsr = Tsf + 460	Tsr	degrees R	593	595	596
Stack Pressure Ps = Pbar + Pg / 13.6	Ps	in. Hg	28.16	28.16	28.16
Duct Area A = $\pi \times D^2 / (4 \times 144)$ or A = L x W / 144	A	Sq. ft	58.992	58.992	58.992
Meter Volume at Standard Conditions Vmstd = 17.64 x Vm x Y x ((Pbar + (DH / 13.6)) / (Tmf + 460))	Vmstd-ft3	cubic feet	81.14	79.06	78.29
Meter Volume at Standard Conditions Vmstd-m3 = Vmstd-ft3 x 0.02832	Vmstd-m3	cubic meter	2.30	2.24	2.22
Average Moisture Content of Stack Gas MC = ((0.04175 x Vwc + 0.04715 x Vwsg) / ((0.04715 x Vwc + 0.04715 x Vwsg) + (Vmstd)) x 100	MC	% Vol	15.38	15.18	15.15
Molecular Weight of Stack Gas, dry Md = (0.44 x %CO <sub>2</sub> ) + (0.32 x %O <sub>2</sub> ) + (0.28 x (%N <sub>2</sub> + %CO))	Md	lb/lbmol	29.15	29.15	29.15
Molecular Weight of Stack Gas, wet Ms = Md x (1 - (MC/100)) + 18 x (MC/100)	Ms	lb/lbmol	27.43	27.46	27.46
Average Stack Gas Velocity Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )	Vs	ft/sec	61.97	61.96	61.26
Actual Volumetric Air Flow Rate Qa = 60 x Vs x A	Qa	acfm	219,345	219,325	216,822
Volumetric Air Flow Rate at Standard Conditions Qs = Qa x (528 / (Ts + 460)) x (Ps / 29.92)	Qs	scfm	183,871	183,134	180,879
Dry Volumetric Air Flow Rate at Standard Conditions Qd = Qa x (1 - (MC / 100)) x (528 / Tsr) x (Ps / 29.92)	Qd	dscfm	155,597	155,342	153,481
Nozzle Cross-Sectional Area An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)	An	sq. ft	0.000252	0.000252	0.000252
Isokinetic Variation I = (0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1 - (MC / 100)))	I	%	101.8	99.3	99.5

Determination of Speciated Mercury Concentration and Emissions by Ontario Hydro Method  
ASTM Method D6784 Ontario-Hydro

Indurating Furnace Stack D (SV017)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	6/24/2020	6/24/2020	6/24/2020
Test Period	-	-	0810 - 1016	1040 - 1245	1300 - 1506
Run Time	theta	min	120	120	120
Meter Volume at Standard Conditions Vmstd	Vmstd-ft3	cubic feet	81.14	79.06	78.29
Meter Volume at Standard Conditions Vmstd	Vmstd-m3	cubic meter	2.30	2.24	2.22
Dry Volumetric Air Flow Rate at Standard Conditions (M2,M4, ISO Calcs)	Qd	DSCFM	155,597	155,342	153,481
Ontario Hydro Mercury Analytical Results					
Probe Rinse (0.1 N HNO <sub>3</sub> )	Hg <sub>pr</sub>	ug	0.019	0.024	0.018
Filter	Hg <sub>filter</sub>	ug	0.009	0.042	0.007
Oxidized Mercury (KCl)	Hg <sub>KCl</sub>	ug	1.50	1.33	1.69
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	Hg <sub>H2O2</sub>	ug	0.048	0.032	0.031
Elemental Mercury (KMnO <sub>4</sub> )	Hg <sub>KMnO4</sub>	ug	8.83	7.99	7.94
Total Mercury	Hg <sub>(total)</sub>	ug	10.40	9.42	9.68
Calculated Data					
Mercury Concentrations	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: Hg <sup>tp</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) / Vmstd-m3	Hg <sup>tp</sup>	ug/dscm	0.012	0.029	0.011
Oxidized Hg: Hg <sup>O</sup> = Hg <sub>KCl</sub> / Vmstd-m3	Hg <sup>O</sup>	ug/dscm	0.653	0.594	0.762
Elemental Hg: Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) / Vmstd-m3	Hg <sup>E</sup>	ug/dscm	3.864	3.583	3.593
Total Hg: Hg <sup>tot</sup> = Hg <sub>(total)</sub> / Vmstd-m3	Hg <sup>tot</sup>	ug/dscm	4.528	4.206	4.366
Mercury Emission Rates	Symbol	Units	Run 1	Run 2	Run 3
Particulate Hg: E-Hg <sup>tp</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>tp</sup>	lb/hr	0.000007	0.000017	0.000006
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>O</sup>	lb/hr	0.000380	0.000346	0.000438
Elemental Hg: E-Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>E</sup>	lb/hr	0.002252	0.002085	0.002066
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> x 2.2046 x 10 <sup>-9</sup> / Vstd-ft3 x 60 x dscfm	E-Hg <sup>tot</sup>	lb/hr	0.002639	0.002448	0.002510

## **Appendix B**

### **Field Data Sheets**

## EPA METHOD 2 FIELD DATA SHEET

A  
ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-6 Probe ID 5-6 Bar. Pres 28.25 in Hg  
Smpl Loc Furnace Stack A SV014 Meter Y 0.9802 Pitot No. 5-6 Stat. Pres -0.90 in H<sub>2</sub>O  
Test No. 1 Run 1 Orifice H@ 1.7424 Pitot Cp 0.84 Probe Lgth 5 ft  
Date 6-23-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 8948

Sample Train Leak Rate (cfm)		
Pretest	<u>0.2</u>	at <u>1'</u> in Hg
Posttest	<u>0.2</u>	at <u>7'</u> in Hg
Pitot (3 in.)	Pos <input checked="" type="checkbox"/>	Neg <input checked="" type="checkbox"/>

Sample Point	Sample Time $\Delta t$	Meter Volume $V_m, \pi'$	Velocity $\Delta P, \text{ in H}_2\text{O}$	Orifice $\Delta H, \text{ in H}_2\text{O}$	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. $T_s, ^\circ F$	Sample Train Temperatures, $^\circ F$					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	<u>0808</u>	<u>10.57</u>											
A-6	5	<u>14.09</u>	<u>0.88</u>	<u>1.57</u>		<u>2.5</u>	<u>119</u>	<u>250</u>	<u>254</u>	<u>61</u>	<u>64</u>	<u>63</u>	<u>19.8</u>
5	10	<u>17.68</u>	<u>0.87</u>	<u>1.55</u>		<u>2.5</u>	<u>121</u>	<u>251</u>	<u>242</u>	<u>62</u>	<u>64</u>	<u>63</u>	
4	15	<u>21.29</u>	<u>0.84</u>	<u>1.49</u>		<u>2.5</u>	<u>121</u>	<u>250</u>	<u>248</u>	<u>63</u>	<u>65</u>	<u>64</u>	
3	20	<u>24.95</u>	<u>0.86</u>	<u>1.51</u>		<u>2.5</u>	<u>120</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>66</u>	<u>64</u>	
2	25	<u>28.47</u>	<u>0.77</u>	<u>1.37</u>		<u>2.0</u>	<u>121</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>67</u>	<u>64</u>	
1	30	<u>31.97</u>	<u>0.86</u>	<u>1.36</u>		<u>2.0</u>	<u>121</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>68</u>	<u>65</u>	
B-6	35	<u>35.84</u>	<u>0.98</u>	<u>1.76</u>		<u>2.5</u>	<u>119</u>	<u>250</u>	<u>252</u>	<u>64</u>	<u>69</u>	<u>65</u>	<u>19.8</u>
5	40	<u>39.92</u>	<u>0.98</u>	<u>1.76</u>		<u>3.0</u>	<u>119</u>	<u>251</u>	<u>249</u>	<u>63</u>	<u>70</u>	<u>65</u>	
4	45	<u>43.72</u>	<u>0.96</u>	<u>1.73</u>		<u>3.0</u>	<u>119</u>	<u>249</u>	<u>251</u>	<u>62</u>	<u>71</u>	<u>66</u>	
3	50	<u>47.68</u>	<u>0.97</u>	<u>1.75</u>		<u>3.0</u>	<u>119</u>	<u>250</u>	<u>251</u>	<u>63</u>	<u>72</u>	<u>67</u>	
2	55	<u>51.53</u>	<u>0.83</u>	<u>1.50</u>		<u>2.0</u>	<u>119</u>	<u>249</u>	<u>248</u>	<u>63</u>	<u>73</u>	<u>67</u>	
1	60	<u>55.12</u>	<u>0.83</u>	<u>1.50</u>		<u>3.0</u>	<u>118</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>73</u>	<u>68</u>	
C-6	65	<u>59.00</u>	<u>0.97</u>	<u>1.76</u>		<u>3.0</u>	<u>118</u>	<u>250</u>	<u>254</u>	<u>64</u>	<u>73</u>	<u>68</u>	
5	70	<u>63.01</u>	<u>0.98</u>	<u>1.74</u>		<u>3.0</u>	<u>118</u>	<u>250</u>	<u>249</u>	<u>63</u>	<u>74</u>	<u>69</u>	
4	75	<u>66.78</u>	<u>0.94</u>	<u>1.70</u>		<u>2.5</u>	<u>119</u>	<u>250</u>	<u>251</u>	<u>63</u>	<u>75</u>	<u>69</u>	
3	80	<u>70.57</u>	<u>0.94</u>	<u>1.71</u>		<u>2.5</u>	<u>118</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>75</u>	<u>69</u>	
2	85	<u>74.28</u>	<u>0.84</u>	<u>1.53</u>		<u>2.5</u>	<u>118</u>	<u>250</u>	<u>249</u>	<u>66</u>	<u>75</u>	<u>70</u>	
1	90	<u>77.81</u>	<u>0.79</u>	<u>1.44</u>		<u>2.5</u>	<u>118</u>	<u>249</u>	<u>248</u>	<u>65</u>	<u>75</u>	<u>70</u>	
D-6	95	<u>81.61</u>	<u>0.87</u>	<u>1.58</u>		<u>2.5</u>	<u>118</u>	<u>251</u>	<u>249</u>	<u>66</u>	<u>74</u>	<u>71</u>	
5	100	<u>85.27</u>	<u>0.87</u>	<u>1.58</u>		<u>2.5</u>	<u>119</u>	<u>250</u>	<u>249</u>	<u>64</u>	<u>75</u>	<u>71</u>	
4	105	<u>89.01</u>	<u>0.84</u>	<u>1.53</u>		<u>2.5</u>	<u>118</u>	<u>250</u>	<u>251</u>	<u>65</u>	<u>76</u>	<u>71</u>	
3	110	<u>92.72</u>	<u>0.84</u>	<u>1.53</u>		<u>2.5</u>	<u>118</u>	<u>250</u>	<u>251</u>	<u>65</u>	<u>76</u>	<u>71</u>	
2	115	<u>96.08</u>	<u>0.74</u>	<u>1.35</u>		<u>2.5</u>	<u>118</u>	<u>249</u>	<u>250</u>	<u>63</u>	<u>77</u>	<u>72</u>	
1	120	<u>99.59</u>	<u>0.73</u>	<u>1.33</u>		<u>2.5</u>	<u>118</u>	<u>249</u>	<u>250</u>	<u>63</u>	<u>76</u>	<u>72</u>	
	<u>0=1015</u>	<u>Vm=89.42</u>	<u>0.87</u>	<u><math>\Delta H=1.57</math></u>			<u><math>T_s=118.42</math></u>					<u><math>T_m=69.73</math></u>	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
<u>62</u>	<u>19.8</u>	<u>12</u>	<u>0808</u>	<u>1015</u>	<u>Stack A-1</u>	<u>10L</u>	<u>0.0</u>	<u>A-1</u>	<u>60722</u>	<u>0.220</u>		
Run 1											1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	<u>898.5</u>	<u>805.5</u>	<u>757.0</u>	<u>758.0</u>	<u>758.4</u>	<u>757.7</u>	<u>759.1</u>	<u>928.4</u>	
Initial wt., g	<u>758.0</u>	<u>700.1</u>	<u>746.5</u>	<u>751.3</u>	<u>759.1</u>	<u>755.2</u>	<u>759.7</u>	<u>956.0</u>	
Difference	<u>140.3</u>	<u>105.4</u>	<u>110.5</u>	<u>106.3</u>	<u>99.7</u>	<u>102.5</u>	<u>99.4</u>	<u>72.4</u>	<u>222.7</u>
	1 N KCl			HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMnO <sub>4</sub>			

Air Flows	
ACFM	DSCFM
<u>193,615</u>	<u>148,639</u>





## ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArcelorMittal Minorca Mine Meter ID C-6 Probe ID 5-6 Bar. Pres 28.25 in Hg  
Smpl Loc Furnace Stack A SV014 Meter Y 0.9802 Pitot No. 5-6 Stat. Pres 20.90 in H<sub>2</sub>O  
Test No. 1 Run 2 Orifice H@ 1.7424 Pitot Cp 0.440.84 Probe Lgth 5 ft  
Date 6-23-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 8948

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>8</u> in Hg
Pitot (3 in.)	Pos <input checked="" type="checkbox"/>	Neg <input checked="" type="checkbox"/>

Sample Point	Sample Time Δt	Meter Volume Vm, ft <sup>3</sup>	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	<u>1035</u>	<u>99.82</u>											
A-6	5	<u>103.71</u>	<u>0.93</u>	<u>1.80</u>		<u>2.5</u>	<u>120</u>	<u>250</u>	<u>251</u>	<u>65</u>	<u>72</u>	<u>71</u>	
5	10	<u>107.45</u>	<u>0.84</u>	<u>1.62</u>		<u>2.5</u>	<u>119</u>	<u>250</u>	<u>252</u>	<u>65</u>	<u>72</u>	<u>71</u>	
4	15	<u>111.24</u>	<u>0.86</u>	<u>1.58</u>		<u>2.5</u>	<u>119</u>	<u>249</u>	<u>250</u>	<u>63</u>	<u>73</u>	<u>71</u>	
3	20	<u>114.94</u>	<u>0.86</u>	<u>1.58</u>		<u>2.5</u>	<u>118</u>	<u>250</u>	<u>251</u>	<u>63</u>	<u>74</u>	<u>71</u>	
2	25	<u>118.40</u>	<u>0.74</u>	<u>1.36</u>		<u>2.0</u>	<u>118</u>	<u>251</u>	<u>250</u>	<u>64</u>	<u>74</u>	<u>71</u>	
1	30	<u>121.80</u>	<u>0.73</u>	<u>1.35</u>		<u>2.0</u>	<u>118</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>75</u>	<u>71</u>	
B-6	35	<u>125.37</u>	<u>0.98</u>	<u>1.80</u>		<u>2.5</u>	<u>119</u>	<u>249</u>	<u>252</u>	<u>66</u>	<u>76</u>	<u>72</u>	
5	40	<u>129.74</u>	<u>0.97</u>	<u>1.78</u>		<u>2.5</u>	<u>121</u>	<u>250</u>	<u>249</u>	<u>59</u>	<u>77</u>	<u>72</u>	
4	45	<u>133.63</u>	<u>0.98</u>	<u>1.81</u>		<u>2.5</u>	<u>120</u>	<u>250</u>	<u>251</u>	<u>57</u>	<u>77</u>	<u>73</u>	
3	50	<u>137.58</u>	<u>0.96</u>	<u>1.77</u>		<u>2.5</u>	<u>121</u>	<u>250</u>	<u>249</u>	<u>55</u>	<u>78</u>	<u>73</u>	
2	55	<u>141.12</u>	<u>0.80</u>	<u>1.44</u>		<u>2.0</u>	<u>120</u>	<u>250</u>	<u>250</u>	<u>55</u>	<u>79</u>	<u>73</u>	
1	60	<u>144.81</u>	<u>0.81</u>	<u>1.50</u>		<u>2.0</u>	<u>118</u>	<u>250</u>	<u>251</u>	<u>56</u>	<u>79</u>	<u>74</u>	
C-6	65	<u>148.76</u>	<u>0.94</u>	<u>1.74</u>		<u>2.5</u>	<u>119</u>	<u>251</u>	<u>251</u>	<u>57</u>	<u>78</u>	<u>74</u>	
5	70	<u>152.71</u>	<u>1.00</u>	<u>1.84</u>		<u>3.0</u>	<u>122</u>	<u>249</u>	<u>251</u>	<u>56</u>	<u>79</u>	<u>74</u>	
4	75	<u>156.60</u>	<u>0.94</u>	<u>1.74</u>		<u>2.5</u>	<u>121</u>	<u>251</u>	<u>252</u>	<u>58</u>	<u>79</u>	<u>75</u>	
3	80	<u>160.57</u>	<u>0.97</u>	<u>1.80</u>		<u>2.5</u>	<u>120</u>	<u>250</u>	<u>249</u>	<u>58</u>	<u>79</u>	<u>75</u>	
2	85	<u>164.19</u>	<u>0.82</u>	<u>1.52</u>		<u>2.5</u>	<u>120</u>	<u>250</u>	<u>250</u>	<u>59</u>	<u>79</u>	<u>75</u>	
1	90	<u>167.90</u>	<u>0.81</u>	<u>1.50</u>		<u>2.5</u>	<u>121</u>	<u>249</u>	<u>249</u>	<u>59</u>	<u>79</u>	<u>75</u>	
D-6	95	<u>171.64</u>	<u>0.89</u>	<u>1.65</u>		<u>3.0</u>	<u>119</u>	<u>250</u>	<u>251</u>	<u>62</u>	<u>78</u>	<u>75</u>	
5	100	<u>175.51</u>	<u>0.87</u>	<u>1.60</u>		<u>3.0</u>	<u>123</u>	<u>249</u>	<u>251</u>	<u>61</u>	<u>79</u>	<u>75</u>	
4	105	<u>179.22</u>	<u>0.85</u>	<u>1.56</u>		<u>3.0</u>	<u>124</u>	<u>250</u>	<u>249</u>	<u>62</u>	<u>80</u>	<u>75</u>	
3	110	<u>183.00</u>	<u>0.80</u>	<u>1.48</u>		<u>2.5</u>	<u>123</u>	<u>250</u>	<u>251</u>	<u>63</u>	<u>80</u>	<u>76</u>	
2	115	<u>186.33</u>	<u>0.71</u>	<u>1.51</u>		<u>2.5</u>	<u>122</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>79</u>	<u>76</u>	
1	120	<u>189.76</u>	<u>0.71</u>	<u>1.31</u>		<u>2.5</u>	<u>122</u>	<u>250</u>	<u>250</u>	<u>65</u>	<u>79</u>	<u>75</u>	
	<u>0=1042</u>	<u>Vm=1.94</u>	<u>0.87</u>	<u>ΔH=1.60</u>			<u>Ts=120.24</u>					<u>Tm=75.35</u>	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min* at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
<u>71</u>	<u>14.8</u>	<u>11.3</u>	<u>1035</u>	<u>1242</u>	<u>Stack A-2</u>	<u>10.2</u>	<u>0.0</u>	<u>7-A</u>	<u>Stack A-1</u>	<u>0.220</u>		
Run 1											1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	<u>910.1</u>	<u>785.9</u>	<u>768.1</u>	<u>767.7</u>	<u>768.8</u>	<u>760</u>	<u>758.5</u>	<u>963.5</u>	
Initial wt., g	<u>762.8</u>	<u>746.1</u>	<u>760.7</u>	<u>762.3</u>	<u>768.4</u>	<u>759.3</u>	<u>760.0</u>	<u>940.9</u>	
Difference	<u>147.3</u>	<u>39.8</u>	<u>7.4</u>	<u>5.4</u>	<u>0.1</u>	<u>0.7</u>	<u>-1.5</u>	<u>22.6</u>	<u>22.6</u>
	1 N KCl			HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMnO <sub>4</sub>			

Air Flows	
ACFM	DSCFM
<u>194, 839</u>	<u>148, 217</u>

221.8 MN





## ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArcelorMittal Minorca Mine Meter ID C-6 Probe ID 5-6 Bar. Pres 28.25 in Hg  
Smpl Loc Furnace Stack A SV014 Meter Y 0.9802 Pitot No. 5-6 Stat. Pres -0.90 in H<sub>2</sub>O  
Test No. 1 Run 3 Orifice H@ 1.7424 Pitot Cp 0.8884 Probe Lgth 5 ft  
Date 6-23 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 0943

Sample Train Leak Rate (cfm)			
Pretest	<u>0.0</u>	at	<u>75</u> in Hg
Posttest	<u>0.0</u>	at	<u>7</u> in Hg
Pitot (3 in.)	Pos <input checked="" type="checkbox"/>	Neg <input type="checkbox"/>	

Sample Point	Sample Time $\Delta t$	Meter Volume $V_m, \pi'$	Velocity $\Delta P,$ in H <sub>2</sub> O	Orifice $\Delta H,$ in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. $T_s, ^\circ F$	Sample Train Temperatures, $^\circ F$					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	<u>1311</u>	<u>190.05</u>											
A-6	5	<u>193.87</u>	<u>0.88</u>	<u>1.59</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>251</u>	<u>66</u>	<u>75</u>	<u>74</u>	
5	10	<u>197.87</u>	<u>0.88</u>	<u>1.58</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>251</u>	<u>63</u>	<u>75</u>	<u>75</u>	
4	15	<u>201.12</u>	<u>0.82</u>	<u>1.48</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>75</u>	<u>74</u>	
3	20	<u>204.67</u>	<u>0.81</u>	<u>1.46</u>		<u>2.0</u>	<u>124</u>	<u>251</u>	<u>249</u>	<u>64</u>	<u>76</u>	<u>74</u>	
2	25	<u>208.00</u>	<u>0.67</u>	<u>1.21</u>		<u>2.0</u>	<u>124</u>	<u>251</u>	<u>250</u>	<u>65</u>	<u>77</u>	<u>74</u>	
1	30	<u>211.14</u>	<u>0.67</u>	<u>1.22</u>		<u>2.0</u>	<u>119</u>	<u>251</u>	<u>250</u>	<u>63</u>	<u>78</u>	<u>74</u>	
B-6	35	<u>215.04</u>	<u>0.97</u>	<u>1.75</u>		<u>2.5</u>	<u>123</u>	<u>251</u>	<u>250</u>	<u>64</u>	<u>79</u>	<u>75</u>	
5	40	<u>218.94</u>	<u>0.98</u>	<u>1.77</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>251</u>	<u>63</u>	<u>80</u>	<u>75</u>	
4	45	<u>222.82</u>	<u>0.45</u>	<u>1.72</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>249</u>	<u>64</u>	<u>80</u>	<u>76</u>	
3	50	<u>226.75</u>	<u>0.94</u>	<u>1.70</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>81</u>	<u>76</u>	
2	55	<u>230.42</u>	<u>0.87</u>	<u>1.58</u>		<u>2.0</u>	<u>124</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>82</u>	<u>77</u>	
1	60	<u>234.06</u>	<u>0.84</u>	<u>1.53</u>		<u>2.0</u>	<u>122</u>	<u>250</u>	<u>251</u>	<u>65</u>	<u>82</u>	<u>77</u>	
C-6	65	<u>237.92</u>	<u>0.94</u>	<u>1.71</u>		<u>2.5</u>	<u>121</u>	<u>249</u>	<u>251</u>	<u>66</u>	<u>80</u>	<u>77</u>	
5	70	<u>241.80</u>	<u>0.95</u>	<u>1.73</u>		<u>2.5</u>	<u>122</u>	<u>251</u>	<u>250</u>	<u>65</u>	<u>81</u>	<u>77</u>	
4	75	<u>245.72</u>	<u>0.93</u>	<u>1.69</u>		<u>2.5</u>	<u>123</u>	<u>249</u>	<u>248</u>	<u>65</u>	<u>81</u>	<u>77</u>	
3	80	<u>249.48</u>	<u>0.89</u>	<u>1.62</u>		<u>2.5</u>	<u>122</u>	<u>251</u>	<u>252</u>	<u>66</u>	<u>81</u>	<u>77</u>	
2	85	<u>253.03</u>	<u>0.77</u>	<u>1.40</u>		<u>2.5</u>	<u>122</u>	<u>250</u>	<u>250</u>	<u>64</u>	<u>81</u>	<u>77</u>	
1	90	<u>256.72</u>	<u>0.78</u>	<u>1.42</u>		<u>2.5</u>	<u>123</u>	<u>251</u>	<u>250</u>	<u>64</u>	<u>82</u>	<u>78</u>	
D-6	95	<u>260.64</u>	<u>0.90</u>	<u>1.63</u>		<u>3.0</u>	<u>124</u>	<u>251</u>	<u>250</u>	<u>66</u>	<u>82</u>	<u>78</u>	
5	100	<u>264.34</u>	<u>0.88</u>	<u>1.60</u>		<u>2.0</u>	<u>124</u>	<u>251</u>	<u>250</u>	<u>63</u>	<u>83</u>	<u>78</u>	
4	105	<u>268.18</u>	<u>0.86</u>	<u>1.56</u>		<u>2.0</u>	<u>125</u>	<u>249</u>	<u>251</u>	<u>64</u>	<u>83</u>	<u>78</u>	
3	110	<u>271.77</u>	<u>0.81</u>	<u>1.41</u>		<u>2.0</u>	<u>124</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>83</u>	<u>79</u>	
2	115	<u>275.11</u>	<u>0.72</u>	<u>1.31</u>		<u>2.0</u>	<u>124</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>83</u>	<u>79</u>	
1	120	<u>278.44</u>	<u>0.71</u>	<u>1.29</u>		<u>2.0</u>	<u>123</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>83</u>	<u>79</u>	
$\Sigma$		<u>1983.39</u>	<u>0.85</u>	$\Delta H=1.54$			$T_s=123.21$					$T_m=78.29$	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	<u>76</u>	<u>19.8</u>	<u>11306</u>	<u>1519</u>	<u>Stack A-3</u>	<u>106</u>	<u>12.0</u>	<u>5-2</u>	<u>Stack A-1</u>	<u>0.220</u>		
Run 2												
											1	
											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	<u>910.8</u>	<u>795.8</u>	<u>755.9</u>	<u>759</u>	<u>762.4</u>	<u>757.5</u>	<u>754.2</u>	<u>999.6</u>	
Initial wt., g	<u>762</u>	<u>762.4</u>	<u>749.8</u>	<u>753.8</u>	<u>762.9</u>	<u>759.2</u>	<u>754.7</u>	<u>928.4</u>	
Difference	<u>148.8</u>	<u>33.4</u>	<u>6.1</u>	<u>5.2</u>	<u>0.5</u>	<u>0.7</u>	<u>0.5</u>	<u>71.2</u>	<u>212</u>
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>193,380</u>	<u>196,733</u>



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 1

Project	ArcelorMittal			Meter ID	C-6	Probe ID	5-6	Bar.Press.	28.25	in. Hg	Sample Train Leak Rate, cfm:	
Sample Location	Indurating Furnace Stack A SV014			Meter Y	0.9802	Pitot Tube No.	5-6	Stat Press.	-0.9	in. H2O	Pretest	0.000 at 10 in. Hg
Date	06/23/20			Orifice dH@	1.7424	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 7 in. Hg
Test	1	Run	# 1			Liner Type:	Glass	IMP Out TC	TIO-8948		Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN										Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	0808	10.57												
1	5.0	14.09	0.880	1.57	3.70	14.27	*	119	*	*	*	64	63	12.0
2	10.0	17.68	0.870	1.55	3.68	17.95	*	121	*	*	*	64	63	12.0
3	15.0	21.29	0.840	1.49	3.62	21.56	*	121	*	*	*	65	64	12.0
4	20.0	24.95	0.860	1.54	3.67	25.23	*	120	*	*	*	66	64	12.0
5	25.0	28.47	0.770	1.37	3.47	28.71	*	121	*	*	*	67	64	12.0
6	30.0	31.97	0.760	1.36	3.45	32.16	*	121	*	*	*	68	65	12.0
7	35.0	35.84	0.980	1.76	3.93	36.09	*	119	*	*	*	69	65	12.0
8	40.0	39.92	0.980	1.76	3.94	40.03	*	119	*	*	*	70	65	12.0
9	45.0	43.72	0.960	1.73	3.90	43.93	*	119	*	*	*	71	66	12.0
10	50.0	47.68	0.970	1.75	3.93	47.86	*	119	*	*	*	72	67	12.0
11	55.0	51.53	0.830	1.50	3.64	51.50	*	119	*	*	*	73	67	12.0
12	60.0	55.12	0.830	1.50	3.65	55.15	*	118	*	*	*	73	68	12.0
13	65.0	59.00	0.970	1.76	3.95	59.09	*	118	*	*	*	73	68	12.0
14	70.0	63.01	0.980	1.78	3.97	63.06	*	118	*	*	*	74	69	12.0
15	75.0	66.78	0.940	1.70	3.89	66.95	*	119	*	*	*	75	69	12.0
16	80.0	70.57	0.940	1.71	3.90	70.84	*	118	*	*	*	75	69	12.0
17	85.0	74.28	0.840	1.53	3.68	74.53	*	118	*	*	*	75	70	12.0
18	90.0	77.81	0.790	1.44	3.58	78.11	*	118	*	*	*	75	70	12.0
19	95.0	81.61	0.870	1.58	3.75	81.86	*	118	*	*	*	74	71	12.0
20	100.0	85.27	0.870	1.58	3.75	85.61	*	119	*	*	*	75	71	12.0
21	105.0	89.01	0.840	1.53	3.69	89.30	*	118	*	*	*	76	71	12.0
22	110.0	92.72	0.840	1.53	3.69	92.99	*	118	*	*	*	76	71	12.0
23	115.0	96.08	0.740	1.35	3.47	96.46	*	118	*	*	*	77	72	12.0
24	120.0	99.59	0.730	1.33	3.45	99.92	*	118	*	*	*	76	72	12.0
End Time	1015													
Run Time	120		Avg DH=	1.57			Avg Ts=	118.92				Avg Tm=	69.73	

Integrated Gas Sampling Data :

Bag No.	1
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	A-1
Nozzle No.	Stack A-1
Nozzle Dn.	0.220

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
898.3	805.5	757.0	758.0	758.4	754.3	759.1	978.4	
758.0	760.1	746.5	751.7	759.1	755.2	759.7	956.0	
140.3	45.4	10.5	6.3	-0.7	-0.9	-0.6	22.4	222.7

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 2

Project	ArcelorMittal			Meter ID	C-6	Probe ID	5-6	Bar.Press.	28.25	in. Hg	Sample Train Leak Rate, cfm:	
Sample Location	Indurating Furnace Stack A SV014			Meter Y	0.9802	Pitot Tube No.	5-6	Stat Press.	-0.9	in. H2O	Pretest	0.000 at 10 in. Hg
Date	06/23/20			Orifice dH@	1.7424	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 8 in. Hg
Test	1	Run	# 2			Liner Type:	Glass	IMP Out TC	TIO-8948		Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN										Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1035	99.82												
1	5.0	103.71	0.930	1.70	3.89	103.71	*	120	*	*	*	72	71	11.3
2	10.0	107.45	0.880	1.62	3.79	107.49	*	119	*	*	*	72	71	11.3
3	15.0	111.24	0.860	1.58	3.75	111.24	*	119	*	*	*	73	71	11.3
4	20.0	114.94	0.860	1.58	3.75	114.99	*	118	*	*	*	74	71	11.3
5	25.0	118.40	0.740	1.36	3.49	118.48	*	118	*	*	*	74	71	11.3
6	30.0	121.80	0.730	1.34	3.46	121.94	*	118	*	*	*	75	71	11.3
7	35.0	125.77	0.980	1.80	4.01	125.95	*	119	*	*	*	76	72	11.3
8	40.0	129.74	0.970	1.78	3.99	129.93	*	121	*	*	*	77	72	11.3
9	45.0	133.63	0.980	1.81	4.01	133.95	*	120	*	*	*	77	73	11.3
10	50.0	137.58	0.960	1.77	3.97	137.92	*	121	*	*	*	78	73	11.3
11	55.0	141.12	0.800	1.48	3.64	141.56	*	120	*	*	*	79	73	11.3
12	60.0	144.81	0.810	1.50	3.67	145.23	*	118	*	*	*	79	74	11.3
13	65.0	148.76	0.940	1.74	3.95	149.18	*	119	*	*	*	78	74	11.3
14	70.0	152.71	1.000	1.84	4.06	153.24	*	122	*	*	*	79	74	11.3
15	75.0	156.60	0.940	1.74	3.94	157.18	*	121	*	*	*	79	75	11.3
16	80.0	160.57	0.970	1.80	4.01	161.20	*	120	*	*	*	79	75	11.3
17	85.0	164.19	0.820	1.52	3.69	164.89	*	120	*	*	*	79	75	11.3
18	90.0	167.90	0.810	1.50	3.67	168.56	*	121	*	*	*	79	75	11.3
19	95.0	171.64	0.890	1.65	3.85	172.40	*	119	*	*	*	78	75	11.3
20	100.0	175.51	0.870	1.60	3.79	176.19	*	123	*	*	*	79	75	11.3
21	105.0	179.22	0.850	1.56	3.75	179.94	*	124	*	*	*	80	75	11.3
22	110.0	183.00	0.800	1.47	3.64	183.58	*	123	*	*	*	80	76	11.3
23	115.0	186.33	0.710	1.31	3.44	187.02	*	122	*	*	*	79	76	11.3
24	120.0	189.76	0.710	1.31	3.43	190.45	*	122	*	*	*	79	75	11.3
End Time	1242													
Run Time	120		Avg DH=	1.60			Avg Ts=	120.29				Avg Tm=	75.35	

Integrated Gas Sampling Data :

Bag No.	2
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	A-2
Nozzle No.	Stack A-1
Nozzle Dn.	0.220

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
910.1	785.9	768.1	767.7	768.8	760.0	758.5	963.5	
762.8	746.1	760.7	762.3	768.7	759.3	760.0	940.9	
147.3	39.8	7.4	5.4	0.1	0.7	-1.5	22.6	221.8

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 3

Project	ArcelorMittal			Meter ID	C-6	Probe ID	5-6	Bar.Press.	28.25	in. Hg	Sample Train Leak Rate, cfm:	
Sample Location	Indurating Furnace Stack A SV014			Meter Y	0.9802	Pitot Tube No.	5-6	Stat Press.	-0.9	in. H2O	Pretest	0.000 at 10 in. Hg
Date	06/23/20			Orifice dH@	1.7424	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 7 in. Hg
Test	1	Run	# 3			Liner Type:	Glass	IMP Out TC	TIO-8948		Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN										Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1311	190.05												
1	5.0	193.87	0.880	1.62	3.81	193.86	*	124	*	*	*	75	74	11.3
2	10.0	197.57	0.880	1.61	3.79	197.65	*	124	*	*	*	75	75	11.3
3	15.0	201.12	0.820	1.50	3.67	201.32	*	124	*	*	*	75	74	11.3
4	20.0	204.67	0.810	1.48	3.64	204.96	*	124	*	*	*	76	74	11.3
5	25.0	208.00	0.670	1.23	3.32	208.28	*	124	*	*	*	77	74	11.3
6	30.0	211.14	0.670	1.24	3.33	211.61	*	119	*	*	*	78	74	11.3
7	35.0	215.04	0.970	1.78	4.00	215.61	*	123	*	*	*	79	75	11.3
8	40.0	218.94	0.980	1.80	4.02	219.63	*	124	*	*	*	80	75	11.3
9	45.0	222.82	0.950	1.75	3.96	223.59	*	124	*	*	*	80	76	11.3
10	50.0	226.75	0.940	1.73	3.95	227.54	*	124	*	*	*	81	76	11.3
11	55.0	230.42	0.870	1.61	3.80	231.34	*	124	*	*	*	82	77	11.3
12	60.0	234.06	0.840	1.56	3.75	235.09	*	122	*	*	*	82	77	11.3
13	65.0	237.92	0.940	1.75	3.97	239.06	*	121	*	*	*	80	77	11.3
14	70.0	241.80	0.950	1.76	3.98	243.03	*	122	*	*	*	81	77	11.3
15	75.0	245.72	0.930	1.72	3.94	246.97	*	123	*	*	*	81	77	11.3
16	80.0	249.48	0.890	1.65	3.85	250.82	*	122	*	*	*	81	77	11.3
17	85.0	253.03	0.770	1.43	3.59	254.41	*	122	*	*	*	81	77	11.3
18	90.0	256.72	0.780	1.44	3.61	258.02	*	123	*	*	*	82	78	11.3
19	95.0	260.64	0.900	1.67	3.88	261.89	*	124	*	*	*	82	78	11.3
20	100.0	264.34	0.880	1.63	3.83	265.73	*	124	*	*	*	83	78	11.3
21	105.0	268.18	0.860	1.59	3.79	269.52	*	125	*	*	*	83	78	11.3
22	110.0	271.77	0.810	1.50	3.68	273.20	*	124	*	*	*	83	79	11.3
23	115.0	275.11	0.720	1.33	3.48	276.68	*	124	*	*	*	83	79	11.3
24	120.0	278.44	0.710	1.32	3.46	280.13	*	123	*	*	*	83	79	11.3
End Time	1519													
Run Time	120		Avg DH=	1.57			Avg Ts=	123.21				Avg Tm=	78.29	

Integrated Gas Sampling Data :

Bag No.	3
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	A-3
Nozzle No.	Stack A-1
Nozzle Dn.	0.220

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
910.8	795.8	755.9	759.0	762.4	757.5	754.2	999.6	
762.0	762.4	749.8	753.8	762.9	759.2	754.7	978.4	
148.8	33.4	6.1	5.2	-0.5	-1.7	-0.5	21.2	212.0

\* Data Recorded on Field Data Sheet



ONTARIO HYRDO D-6784-16 MERCURY TESTING  
IMPINGER RECOVERY

Project ArcelorMittal Minorca Mine Date 6/23/20  
Project No. 23692044.20 Operators MJN DJK JAR2 BAW  
Source Furnace Stack A - SV014 Sample Location Furnace Stack

TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
END	898.3	805.5	757.0	758.0	758.4	754.3	759.1	978.4
Start	758.0	760.1	746.5	751.7	759.1	755.2	759.7	956.0
CHANGE	140.3	45.4	10.5	6.3	-0.7	-0.9	-0.6	22.4
MASS OF MOISTURE COLLECTED, g								222.7

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
END								
Start	763.3	746.7	750.7	749.9	761.4	754.5	755.0	940.9
CHANGE	762.8	746.1	760.1	762.3	763.7	759.3	760.0	940.9/963.5
MASS OF MOISTURE COLLECTED, g								

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
END	910.8	795.9	755.9	759.0	762.4	757.5	754.2	999.6
Start	762.0	762.4	749.3	753.8	762.9	759.2	754.7	978.4
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 4	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
START.	910.1	785.9	768.1	767.7	768.8	760.0	758.5	963.5
END	762.8	746.1	760.7	762.3	768.7	759.3	760.0	940.9
Start								

COMMENTS

A

\*JAR2  
06/23/20

re-written  
same  
data

**EPA METHOD 3A -- Instrument Analysis Data Sheet**

Project ArcelorMittal  
Sample Location(s): Indurating Furnace Stack A  
Test No: 1  
Date: 06/23/20  
Operators: JAR2

Analyzer Make / Model Servomex 1440  
Analyzer O<sub>2</sub> Range (span), %: 0- 22.5  
Analyzer CO<sub>2</sub> Range (span), %: 0- 9.5

**GAS CONCENTRATION AND IDENTIFICATION**

Calibration Level	Cylinder Serial No.		
		O <sub>2</sub> Cert. Conc.	CO <sub>2</sub> Cert. Conc.
Zero Gas	EB0098633	0.0	0.0
CO <sub>2</sub> Mid	EB0098397	---	4.9
O <sub>2</sub> Mid/CO <sub>2</sub> High	CC106732	9.5	9.5
O <sub>2</sub> High	EB0098397	22.5	---

**PRETEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5

Time of Calibration Start 1555  
Time of Calibration End 1615

**INTEGRATED BAG ANALYSIS**

Location/Test No.	Indurating Furnace Stack A		
Run No.	1	2	3
Time Sampled	1015	1242	1519
Time Analyzed	1600	1603	1605
O <sub>2</sub> , %	19.8	19.8	19.8
CO <sub>2</sub> , %	1.3	1.3	1.3

**POSTTEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5



EPA METHOD 2  
FIELD DATA SHEET

B  
ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArcelorMittal Minorca Mine Meter ID C-6 Probe ID 5-6 Bar. Pres 28.23 in Hg  
Smpl Loc Furnace Stack B SV015 Meter Y 0.9802 Pitot No. 5-6 Stat. Pres -0.93 in H<sub>2</sub>O  
Test No. 1 Run 1 Orifice H@ 1.3424 Pitot Cp 0.84 Probe Lgth 5 ft  
Date 1-24-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 4449  
8948 MN

Sample Train Leak Rate (cfm)		
Pretest	0.0	at 10 in Hg
Posttest	0.0	at 8 in Hg
Pitot (3 in.)	Pos	Neg. <input checked="" type="checkbox"/>

Sample Point	Sample Time Δt	Meter Volume Vm, ft <sup>3</sup>	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	0810	278.69											
A-6	5	282.57	0.94	1.71		2.5	121	250	249	60	66	65	
	10	286.48	0.94	1.70		2.5	124	250	249	63	66	66	
	15	290.07	0.86	1.56		2.0	124	241	251	65	67	66	
	20	293.74	0.85	1.55		2.0	122	250	241	63	67	66	
	25	297.05	0.73	1.33		2.0	121	244	251	62	68	65	
	30	300.42	0.74	1.35		2.0	121	250	249	62	69	67	
B-6	35	304.35	0.00	1.83		3.0	121	244	251	62	70	67	
	40	308.31	1.00	1.83		3.0	122	249	251	61	71	67	
	45	312.27	0.97	1.77		2.5	122	250	249	62	72	67	
	50	316.02	0.95	1.74		2.5	122	251	250	64	73	68	
	55	319.84	0.82	1.51		2.5	121	249	249	64	73	68	
	60	323.33	0.81	1.49		2.5	121	250	251	65	74	69	
C-6	65	327.56	1.05	1.93		3.0	121	251	253	66	73	69	
	70	331.67	1.00	1.83		3.0	123	249	249	65	74	69	
	75	335.61	0.93	1.70		3.0	124	250	249	64	74	70	
	80	339.56	0.95	1.74		3.0	124	251	249	62	75	70	
	85	343.17	0.81	1.49		2.5	123	250	251	61	75	70	
	90	346.81	0.81	1.49		2.5	122	250	251	61	75	71	
D-6	95	350.70	0.94	1.73		3.0	122	250	250	62	75	71	
	100	354.66	0.95	1.74		3.0	124	250	251	63	76	71	
	105	358.48	0.87	1.60		3.0	124	251	251	64	76	71	
	110	362.18	0.88	1.62		3.0	124	251	249	64	76	71	
	115	365.72	0.75	1.38		2.5	124	250	251	64	76	72	
	120	369.28	0.74	1.36		2.5	124	251	250	64	76	72	
	0=1016	Vm=90.59	0.89	ΔH=1.62			Ts=22.54					Tm=70.54	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	65	19.0	0810	1016	Stack B-1	106	0.0	B-1	6-0022	0.220	1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Stack B-1 0.220 MN

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	933.8	785.5	764.0	753.7	763.0	750.2	750.3	987.3	
Initial wt., g	764.5	745.7	756	744.4	762.7	750.4	752.6	963.5	
Difference	164.3	39.8	8.0	4.3	0.3	-0.2	-1.8	23.8	223.8
	1 N KCl		HNO3/H2O2		H2SO4/KMNO4				

Air Flows	
ACFM	DSCFM
197.560	143.577



B  
ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-6 Probe ID 5-6 Bar. Pres 28.23 in Hg  
Smpl Loc Furnace Stack B SV015 Meter Y 0.9802 Pitot No. 5-1 Stat. Pres -0.93 in H<sub>2</sub>O  
Test No. 1 Run 2 Orifice H@ 1.7424 Pitot Cp 0.84 Probe Lgth 5 ft  
Date 6-24-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 0.948

Sample Train Leak Rate (cfm)			
Pretest	0.0	at	16 in Hg
Posttest	0.0	at	8 in Hg
Pitot (3 in.)	Pos	Neg	Dr

Sample Point	Sample Time Δt	Meter Volume Vm, ft <sup>3</sup>	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		369.52											
A-6	5	373.40	0.95	1.67		2.0	126	250	253	61	73	72	
	10	377.20	0.96	1.69		2.0	125	250	251	59	73	72	
	15	380.91	0.92	1.62		2.0	125	250	250	61	73	72	
	20	384.51	0.88	1.54		2.0	127	250	250	64	75	72	
	25	387.91	0.73	1.29		2.0	124	250	249	64	75	72	
	30	391.27	0.73	1.29		2.0	126	250	251	65	76	72	
B-6	35	395.11	1.00	1.77		2.5	125	250	251	65	76	72	
	40	398.94	0.98	1.72		2.5	127	250	249	63	77	73	
	45	402.71	0.95	1.67		2.0	127	250	250	63	78	73	
	50	406.51	0.95	1.68		2.0	126	250	251	63	79	74	
	55	410.07	0.83	1.47		2.0	127	250	250	64	79	74	
	60	413.71	0.82	1.46		2.0	127	250	250	64	80	75	
C-6	65	417.71	0.97	1.72		2.5	126	248	250	65	80	75	
	70	421.69	0.98	1.74		2.5	127	249	249	65	80	75	
	75	425.62	0.91	1.61		2.5	128	250	250	65	81	76	
	80	429.47	0.92	1.63		2.5	127	250	251	65	81	76	
	85	433.08	0.81	1.44		2.0	127	250	251	64	81	76	
	90	436.64	0.81	1.44		2.0	127	250	251	64	82	77	
D-6	95	440.55	0.93	1.65		2.5	128	251	252	66	82	77	
	100	444.32	0.92	1.63		2.5	128	250	250	65	82	77	
	105	448.01	0.84	1.49		2.5	128	250	251	65	82	77	
	110	451.68	0.87	1.54		2.5	128	248	249	64	82	78	
	115	455.21	0.73	1.30		2.0	127	250	251	63	83	78	
	120	458.72	0.73	1.30		2.0	128	250	249	64	83	78	
Σ=		Vm=39.20	0.88	ΔH=1.50			T <sub>s</sub> =126.58					T <sub>me</sub> =76.79	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	73	19	1040	1245	Stack B-2	102	0.0	B-2	Stack B-1	0.220	1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	920.2	802.3	757.7	759.9	760.7	753.0	741.1	954.2	
Initial wt., g	759.7	760.5	749.3	754.3	761.4	754.1	742.5	930.4	
Difference	160.5	41.8	8.4	5.6	-0.7	-1.1	-1.4	23.8	236.9
	1 N KCl		HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMNO <sub>4</sub>				

Air Flows	
ACFM	DSCFM
147.563	147.195



B  
ONTARIO HYDRD D-6784-16 MERCURY TESTING  
FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-6 Probe ID 5-6 Bar. Pres 28.23 in Hg  
Smpl Loc Furnace Stack B SV015 Meter Y 0.9852 Pitot No. 5-2 Stat. Pres -0.93 in H<sub>2</sub>O  
Test No. 1 Run 3 Orifice H@ 1.7424 Pitot Cp 0.84 Probe Lgth 5 ft  
Date 6-24-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other  
Sample Train Leak Rate (cfm)  
Pretest 0.0 at 10 in Hg  
Posttest 0.0 at 8 in Hg  
Pitot (3 in.) Pos. ☒ Neg. ☒

Sample Point	Sample Time Δt	Meter Volume Vm, π'	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	1300	458.95											
A-6	5	462.85	0.95	1.72		2.5	128	251	248	65	79	78	
	10	466.84	0.95	1.72		2.5	128	250	251	65	79	78	
	15	470.67	0.90	1.63		2.5	128	250	252	63	79	78	
	20	474.47	0.91	1.65		2.5	128	249	250	64	80	78	
	25	477.96	0.96	1.38		2.0	127	250	251	64	81	78	
	30	481.44	0.73	1.32		2.0	127	250	250	63	82	78	
B-6	35	485.53	1.50	1.81		3.0	128	250	250	65	81	78	
	40	489.57	1.55	1.90		3.0	128	251	250	64	82	78	
	45	493.48	0.95	1.72		2.5	128	250	251	65	82	78	
	50	497.38	0.97	1.76		2.5	128	250	248	65	82	79	
	55	501.52	0.78	1.42		2.0	128	249	247	66	83	79	
	60	504.57	0.82	1.44		2.0	128	249	250	65	83	79	
C-6	65	508.76	1.10	2.00		3.0	128	251	252	66	83	79	
	70	512.91	1.05	1.91		3.0	128	249	249	63	84	79	
	75	516.81	0.94	1.71		2.5	129	251	250	63	84	80	
	80	520.67	0.93	1.69		2.5	128	249	250	64	85	80	
	85	524.34	0.82	1.49		2.5	128	249	250	65	85	80	
	90	527.96	0.78	1.42		2.5	127	249	251	66	85	80	
D-6	95	531.82	0.94	1.71		3.0	128	251	248	66	84	81	
	100	535.75	0.94	1.71		3.0	129	250	250	65	85	81	
	105	539.44	0.87	1.58		2.5	129	250	249	64	85	81	
	110	543.22	0.87	1.59		2.5	128	250	250	64	85	81	
	115	546.63	0.71	1.29		2.5	128	250	251	61	86	81	
	120	550.52	0.69	1.26		2.5	128	250	251	62	86	81	
Σ=		Vm=91.58	0.89	ΔH=1.62			T <sub>s</sub> =128					T <sub>m</sub> =81.10	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	79	19.0	1300	1506	Stack B-3	102	0.0	B-3	Stack B-1	0.220	1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	913.7	767.3	767.0	763.2	763.0	722.8	743.1	875.4	
Initial wt., g	756.3	747.9	756.3	759.0	762.5	722.7	742.8	848.2	
Difference	156.9	39.4	8.7	4.2	0.5	0.1	0.3	27.2	237.3
	1 N KCl		HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMNO <sub>4</sub>				

Air Flows	
ACFM	DSCFM
198,936	148,171



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 1

Project	ArcelorMittal		Meter ID	C-6	Probe ID	5-6	Bar.Press.	28.23	in. Hg	Sample Train Leak Rate, cfm:			
Sample Location	Indurating Furnace Stack B SV015		Meter Y	0.9802	Pitot Tube No.	5-6	Stat Press.	-0.9	in. H2O	Pretest	0.000	at 10	in. Hg
Date	06/24/20		Orifice dH@	1.7424	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000	at 8	in. Hg
Test	1	Run #	1		Liner Type:	Glass	IMP Out TC	TIO-8948		Pretest Pitot leak Check Pos	PASS	@ >3" w.c	
Operators	DJK /MJN									Posttest Pitot leak Check Neg	PASS	@ >3" w.c	

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	0810	278.69												
1	5.0	282.57	0.940	1.71	3.87	282.56	*	121	*	*	*	66	65	11.0
2	10.0	286.48	0.940	1.70	3.86	286.42	*	124	*	*	*	66	66	11.0
3	15.0	290.07	0.860	1.56	3.70	290.12	*	124	*	*	*	67	66	11.0
4	20.0	293.74	0.850	1.55	3.69	293.80	*	122	*	*	*	67	66	11.0
5	25.0	297.05	0.730	1.33	3.42	297.23	*	121	*	*	*	68	66	11.0
6	30.0	300.42	0.740	1.35	3.45	300.67	*	121	*	*	*	69	67	11.0
7	35.0	304.35	1.000	1.83	4.01	304.68	*	121	*	*	*	70	67	11.0
8	40.0	308.31	1.000	1.83	4.01	308.70	*	122	*	*	*	71	67	11.0
9	45.0	312.27	0.970	1.77	3.95	312.65	*	122	*	*	*	72	67	11.0
10	50.0	316.02	0.950	1.74	3.92	316.57	*	122	*	*	*	73	68	11.0
11	55.0	319.84	0.820	1.51	3.65	320.22	*	121	*	*	*	73	68	11.0
12	60.0	323.33	0.810	1.49	3.63	323.85	*	121	*	*	*	74	69	11.0
13	65.0	327.56	1.050	1.93	4.14	327.99	*	121	*	*	*	73	69	11.0
14	70.0	331.67	1.000	1.83	4.03	332.01	*	123	*	*	*	74	69	11.0
15	75.0	335.61	0.930	1.70	3.88	335.90	*	124	*	*	*	74	70	11.0
16	80.0	339.56	0.950	1.74	3.93	339.83	*	124	*	*	*	75	70	11.0
17	85.0	343.17	0.810	1.49	3.64	343.47	*	123	*	*	*	75	70	11.0
18	90.0	346.81	0.810	1.49	3.64	347.11	*	122	*	*	*	75	71	11.0
19	95.0	350.70	0.940	1.73	3.92	351.03	*	122	*	*	*	75	71	11.0
20	100.0	354.66	0.950	1.74	3.94	354.97	*	124	*	*	*	76	71	11.0
21	105.0	358.48	0.870	1.60	3.77	358.74	*	124	*	*	*	76	71	11.0
22	110.0	362.18	0.880	1.62	3.79	362.53	*	124	*	*	*	76	71	11.0
23	115.0	365.72	0.750	1.38	3.50	366.04	*	124	*	*	*	76	72	11.0
24	120.0	369.28	0.740	1.36	3.48	369.52	*	124	*	*	*	76	72	11.0
End Time	1016													
Run Time	120		Avg DH=	1.62			Avg Ts=	122.54				Avg Tm=	70.54	

Integrated Gas Sampling Data :

Bag No.	1
Bag Vol.	20 liters
Leak Rate	0 cc/min

Filter No.	B-1
Nozzle No.	Stack B-1
Nozzle Dn.	0.220

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
933.8	785.5	764.0	753.7	763.0	750.2	750.8	987.3	
769.5	745.7	756.0	749.4	762.7	750.4	752.6	963.5	
164.3	39.8	8.0	4.3	0.3	-0.2	-1.8	23.8	238.5

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 2

Project	ArcelorMittal	Meter ID	C-6	Probe ID	5-6	Bar.Press.	28.23	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Indurating Furnace Stack B SV015	Meter Y	0.9802	Pitot Tube No.	5-6	Stat Press.	-0.9	in. H2O	Pretest 0.000 at 10 in. Hg
Date	06/24/20	Orifice dH@	1.7424	Pitot Cp	0.84	CPM TC	NA	Posttest 0.000 at 8 in. Hg	
Test	1	Run #	2	Liner Type:	Glass	IMP Out TC	TIO-8948	Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN							Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1040	369.52												
1	5.0	373.40	0.950	1.71	3.90	373.42	*	126	*	*	*	73	72	11.8
2	10.0	377.20	0.960	1.73	3.92	377.34	*	125	*	*	*	73	72	11.8
3	15.0	380.91	0.920	1.66	3.84	381.18	*	125	*	*	*	73	72	11.8
4	20.0	384.51	0.880	1.58	3.75	384.93	*	127	*	*	*	75	72	11.8
5	25.0	387.91	0.730	1.32	3.43	388.36	*	124	*	*	*	75	72	11.8
6	30.0	391.27	0.730	1.32	3.43	391.78	*	126	*	*	*	76	72	11.8
7	35.0	395.11	1.000	1.81	4.01	395.79	*	125	*	*	*	76	72	11.8
8	40.0	398.94	0.980	1.77	3.96	399.76	*	127	*	*	*	77	73	11.8
9	45.0	402.71	0.950	1.71	3.91	403.67	*	127	*	*	*	78	73	11.8
10	50.0	406.51	0.950	1.72	3.92	407.59	*	126	*	*	*	79	74	11.8
11	55.0	410.07	0.830	1.50	3.67	411.25	*	127	*	*	*	79	74	11.8
12	60.0	413.71	0.820	1.49	3.66	414.91	*	124	*	*	*	80	75	11.8
13	65.0	417.71	0.970	1.76	3.97	418.88	*	126	*	*	*	80	75	11.8
14	70.0	421.69	0.980	1.78	3.99	422.87	*	127	*	*	*	80	75	11.8
15	75.0	425.65	0.910	1.65	3.84	426.72	*	128	*	*	*	81	76	11.8
16	80.0	429.47	0.920	1.67	3.87	430.59	*	127	*	*	*	81	76	11.8
17	85.0	433.08	0.810	1.47	3.64	434.23	*	127	*	*	*	81	76	11.8
18	90.0	436.64	0.810	1.47	3.64	437.87	*	127	*	*	*	82	77	11.8
19	95.0	440.55	0.930	1.69	3.90	441.77	*	128	*	*	*	82	77	11.8
20	100.0	444.32	0.920	1.67	3.88	445.64	*	128	*	*	*	82	77	11.8
21	105.0	448.01	0.840	1.53	3.71	449.35	*	128	*	*	*	82	77	11.8
22	110.0	451.68	0.870	1.58	3.77	453.12	*	128	*	*	*	82	78	11.8
23	115.0	455.21	0.730	1.33	3.46	456.59	*	127	*	*	*	83	78	11.8
24	120.0	458.72	0.730	1.33	3.46	460.05	*	128	*	*	*	83	78	11.8
End Time	1245													
Run Time	120		Avg DH=	1.59			Avg Ts=	126.58				Avg Tm=	76.79	

Integrated Gas Sampling Data :

Bag No.	2
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	B-2
Nozzle No.	Stack B-1
Nozzle Dn.	0.220

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
920.2	802.3	757.7	759.9	760.7	753.0	741.1	954.2	
759.7	760.5	749.3	754.3	761.4	754.1	742.5	930.4	
160.5	41.8	8.4	5.6	-0.7	-1.1	-1.4	23.8	236.9

\* Data Recorded on Field Data Sheet





## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 3

Project	ArcelorMittal			Meter ID	C-6	Probe ID	5-6	Bar.Press.	28.23	in. Hg	Sample Train Leak Rate, cfm:	
Sample Location	Indurating Furnace Stack B SV015			Meter Y	0.9802	Pitot Tube No.	5-6	Stat Press.	-0.9	in. H2O	Pretest	0.000 at 10 in. Hg
Date	06/24/20			Orifice dH@	1.7424	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 8 in. Hg
Test	1	Run	# 3			Liner Type:	Glass	IMP Out TC	TIO-8948		Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN										Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1300	458.94												
1	5.0	462.85	0.950	1.72	3.93	462.87	*	128	*	*	*	79	78	12.0
2	10.0	466.84	0.950	1.72	3.93	466.80	*	128	*	*	*	79	78	12.0
3	15.0	470.67	0.900	1.63	3.82	470.62	*	128	*	*	*	79	78	12.0
4	20.0	474.47	0.910	1.65	3.84	474.47	*	128	*	*	*	80	78	12.0
5	25.0	477.96	0.760	1.38	3.52	477.99	*	127	*	*	*	81	78	12.0
6	30.0	481.44	0.730	1.32	3.46	481.45	*	127	*	*	*	82	78	12.0
7	35.0	485.53	1.000	1.81	4.04	485.49	*	128	*	*	*	81	78	12.0
8	40.0	489.57	1.050	1.90	4.13	489.62	*	128	*	*	*	82	78	12.0
9	45.0	493.48	0.950	1.72	3.94	493.56	*	128	*	*	*	82	78	12.0
10	50.0	497.38	0.970	1.76	3.98	497.54	*	128	*	*	*	82	79	12.0
11	55.0	501.02	0.780	1.42	3.57	501.11	*	128	*	*	*	83	79	12.0
12	60.0	504.57	0.820	1.49	3.67	504.78	*	128	*	*	*	83	79	12.0
13	65.0	508.76	1.100	2.00	4.24	509.02	*	128	*	*	*	83	79	12.0
14	70.0	512.91	1.050	1.91	4.15	513.17	*	128	*	*	*	84	79	12.0
15	75.0	516.81	0.940	1.71	3.93	517.10	*	129	*	*	*	84	80	12.0
16	80.0	520.67	0.930	1.69	3.91	521.01	*	128	*	*	*	85	80	12.0
17	85.0	524.34	0.820	1.49	3.68	524.68	*	128	*	*	*	85	80	12.0
18	90.0	527.96	0.780	1.42	3.59	528.28	*	127	*	*	*	85	80	12.0
19	95.0	531.82	0.940	1.71	3.94	532.21	*	128	*	*	*	84	81	12.0
20	100.0	535.75	0.940	1.71	3.93	536.14	*	129	*	*	*	85	81	12.0
21	105.0	539.44	0.870	1.58	3.79	539.93	*	129	*	*	*	85	81	12.0
22	110.0	543.22	0.870	1.59	3.79	543.72	*	128	*	*	*	85	81	12.0
23	115.0	546.63	0.710	1.29	3.43	547.15	*	128	*	*	*	86	81	12.0
24	120.0	550.52	0.690	1.26	3.38	550.53	*	128	*	*	*	86	81	12.0
End Time	1506													
Run Time	120		Avg DH=	1.62			Avg Ts=	128.00				Avg Tm=	81.10	

Integrated Gas Sampling Data :

Bag No.	3
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	B-3
Nozzle No.	Stack B-1
Nozzle Dn.	0.220

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
913.7	787.3	767.0	763.2	763.0	722.8	783.1	875.4	
756.8	747.9	758.3	759.0	762.5	722.7	782.8	848.2	
156.9	39.4	8.7	4.2	0.5	0.1	0.3	27.2	237.3

\* Data Recorded on Field Data Sheet



B

**ONTARIO HYRDO D-6784-16 MERCURY TESTING  
IMPINGER RECOVERY**

Project ArcelorMittal Minorca Mine Date 6/24/20  
Project No. 23692044.20 Operators MJN DJK JAR2 BAW  
Source Furnace Stack B - SV015 Sample Location Furnace Stack

TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	933.8	785.5	764.0	753.7	763.0	750.2	750.8	987.3
Start	769.5	745.7	756.0	749.4	762.7	750.4	752.6	963.5
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	920.2	802.3	751.7	759.9	760.7	753.0	741.1	954.2
Start	759.7	760.5	749.3	754.3	761.4	754.1	742.5	930.4
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	913.7	787.3	767.0	763.2	763.0	722.8	783.1	875.4
Start	756.8	747.9	758.3	759.0	762.5	722.7	782.8	848.2
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 4	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.								
END								
Start								

COMMENTS

**EPA METHOD 3A -- Instrument Analysis Data Sheet**

Project ArcelorMittal  
Sample Location(s): Indurating Furnace Stack B  
Test No: 1  
Date: 06/23/20  
Operators: JAR2

Analyzer Make / Model Servomex 1440  
Analyzer O<sub>2</sub> Range (span), %: 0- 22.5  
Analyzer CO<sub>2</sub> Range (span), %: 0- 9.5

**GAS CONCENTRATION AND IDENTIFICATION**

Calibration Level	Cylinder Serial No.		
		O <sub>2</sub> Cert. Conc.	CO <sub>2</sub> Cert. Conc.
Zero Gas	EB0098633	0.0	0.0
CO <sub>2</sub> Mid	EB0098397	---	4.9
O <sub>2</sub> Mid/CO <sub>2</sub> High	CC106732	9.5	9.5
O <sub>2</sub> High	EB0098397	22.5	---

**PRETEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5

Time of Calibration Start 1535  
Time of Calibration End 1605

**INTEGRATED BAG ANALYSIS**

Location/Test No.	Indurating Furnace Stack B		
Run No.	1	2	3
Time Sampled	1016	1245	1506
Time Analyzed	1535	1548	1550
O <sub>2</sub> , %	19.0	19.0	19.0
CO <sub>2</sub> , %	1.9	1.9	1.9

**POSTTEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.1	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5



	Run 1	Run 2	Run 3	Run 4
Bar Press (In Hg)	28.25			
Stat. Press (In H <sub>2</sub> O)	~0.9			
Temp - Dry Bulb °F				
Temp - Wet Bulb °F				
Moist Content - %				
O <sub>2</sub> %				
Time of Meas.	67:30			

[illegible]

	Run 1	Run 2	Run 3	Run 4
Stack Pres. - In Hg				
Duct Area - Sq Ft.				
Mole Weight - Md				
Mole Weight - Ms				
Avg. Temp. - °F				
Average $\sqrt{\Delta P}$				
Gas Vel - Ft/Sec				
ACFM				
SCFM				
DSCFM				

### Schematic of Duct Cross-Section



C  
ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-14 Probe ID 6-4 Bar. Pres 28.25 in Hg  
Smpl Loc Furnace Stack C SV016 Meter Y 0.9831 Pitot No. 6-4 Stat. Pres 20.90 in H<sub>2</sub>O  
Test No. 1 Run I Orifice H@ 2.0315 Pitot Cp 0.84 Probe Lgth 6 ft  
Date 6-23-21 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 4444  
Sample Train Leak Rate (cfm)  
Pretest 0.0 at 10 in Hg  
Posttest 0.0 at 8 in Hg  
Pitot (3 in.) Pos. ☒ Neg. ☐

Sample Point	Sample Time Δt	Meter Volume Vm, π	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. T <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	0808	471.22											
A-6	5	474.27	0.72	1.34		2.5	122	250	251	63	61	61	18.8
5	10	477.32	0.73	1.36		2.5	122	255	251	64	60	60	
4	15	480.35	0.69	1.28		2.5	123	254	251	63	60	60	
3	20	483.47	0.68	1.26		2.5	122	255	251	64	61	61	
2	25	486.34	0.60	1.12		2.0	122	255	247	63	61	61	
1	30	489.07	0.59	1.10		2.0	122	255	249	62	61	61	
B-6	35	492.53	0.80	1.49		2.5	122	255	251	63	62	62	
5	40	495.77	0.78	1.46		2.5	122	256	251	59	62	62	18.7
4	45	499.05	0.76	1.42		2.5	122	257	252	58	63	63	
3	50	502.42	0.75	1.40		2.5	122	255	251	57	63	63	
2	55	505.48	0.66	1.23		2.5	123	255	250	58	64	64	
1	60	508.44	0.65	1.22		2.5	122	254	253	59	64	64	
C-6	65	511.55	0.75	1.41		2.5	121	255	254	61	64	64	
5	70	514.68	0.73	1.48		2.5	122	256	254	59	65	65	
4	75	517.78	0.71	1.33		2.5	122	255	250	59	65	65	
3	80	520.81	0.71	1.33		2.5	122	255	248	61	65	65	
2	85	523.86	0.62	1.16		2.5	122	255	254	63	66	66	
1	90	526.92	0.69	1.30		2.5	122	255	240	64	66	66	
D-6	95	530.17	0.75	1.48		2.5	122	256	257	65	66	66	
5	100	533.31	0.76	1.43		2.5	122	255	259	64	67	67	
4	105	536.67	0.75	1.41		3.0	122	254	248	64	67	67	
3	110	539.80	0.71	1.34		3.0	122	255	250	64	67	67	
2	115	542.86	0.68	1.28		2.5	122	255	250	63	67	67	
1	120	545.83	0.67	1.26		2.5	122	255	252	63	68	68	
Ø=1015		Vm=74.61	0.71	ΔH=1.32			T <sub>s</sub> =122.4					T <sub>m</sub> =63.96	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	61	18.8	0808	1015	Stack C-1	102	0.0	C-1	6.0.215	0.223	1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	916.9	801.7	815.4	768.5	758.0	762.4	773.3	966.6	
Initial wt., g	760.9	754.2	803.7	763.7	756.1	763.0	773.0	949.1	
Difference	156	47.3	7.7	5.2	1.9	0.6	0.7	17.5	23.3
	1 N KCl		HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMnO <sub>4</sub>				

Air Flows	
ACFM	DSCFM
187,561	137,300



## ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArcelorMittal Minorca Mine Meter ID C-14 Probe ID 6-4 Bar. Pres 28.25 in Hg  
Smpl Loc Furnace Stack C SV016 Meter Y 0.9831 Pitot No. 6-4 Stat. Pres 29.90 in H<sub>2</sub>O  
Test No. 1 Run 2 Orifice H@ 2.0315 Pitot Cp 0.84 Probe Lgth 6 ft  
Date 6-27-72 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TG 4449

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>8</u> in Hg
Pitot (3 in.)	Pos <input checked="" type="checkbox"/>	Neg. <input checked="" type="checkbox"/>

Sample Point	Sample Time Δt	Meter Volume vm, ft <sup>3</sup>	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	<u>1035</u>	<u>546.68</u>											
A-6	5	<u>574.95</u>	<u>0.71</u>	<u>1.33</u>		<u>2.0</u>	<u>122</u>	<u>254</u>	<u>252</u>	<u>65</u>	<u>67</u>	<u>67</u>	<u>18.3</u>
	10	<u>552.92</u>	<u>0.71</u>	<u>1.32</u>		<u>2.0</u>	<u>124</u>	<u>255</u>	<u>250</u>	<u>63</u>	<u>68</u>	<u>68</u>	
	15	<u>556.01</u>	<u>0.66</u>	<u>1.23</u>		<u>2.0</u>	<u>124</u>	<u>254</u>	<u>251</u>	<u>62</u>	<u>67</u>	<u>67</u>	
	20	<u>559.02</u>	<u>0.66</u>	<u>1.23</u>		<u>2.0</u>	<u>124</u>	<u>255</u>	<u>249</u>	<u>62</u>	<u>68</u>	<u>68</u>	
	25	<u>562.05</u>	<u>0.62</u>	<u>1.16</u>		<u>2.0</u>	<u>123</u>	<u>255</u>	<u>252</u>	<u>62</u>	<u>68</u>	<u>68</u>	
	30	<u>564.96</u>	<u>0.61</u>	<u>1.14</u>		<u>2.0</u>	<u>123</u>	<u>255</u>	<u>251</u>	<u>62</u>	<u>68</u>	<u>68</u>	<u>18.5</u>
B-6	35	<u>568.21</u>	<u>0.60</u>	<u>1.50</u>		<u>2.0</u>	<u>122</u>	<u>254</u>	<u>241</u>	<u>66</u>	<u>68</u>	<u>68</u>	
	40	<u>571.43</u>	<u>0.78</u>	<u>1.46</u>		<u>2.0</u>	<u>122</u>	<u>255</u>	<u>250</u>	<u>62</u>	<u>69</u>	<u>69</u>	
	45	<u>574.67</u>	<u>0.71</u>	<u>1.33</u>		<u>2.5</u>	<u>122</u>	<u>250</u>	<u>248</u>	<u>60</u>	<u>69</u>	<u>69</u>	
	50	<u>577.72</u>	<u>0.70</u>	<u>1.31</u>		<u>2.5</u>	<u>122</u>	<u>250</u>	<u>248</u>	<u>58</u>	<u>69</u>	<u>69</u>	
	55	<u>580.71</u>	<u>0.61</u>	<u>1.14</u>		<u>2.0</u>	<u>122</u>	<u>255</u>	<u>251</u>	<u>57</u>	<u>70</u>	<u>70</u>	
	60	<u>583.58</u>	<u>0.59</u>	<u>1.11</u>		<u>2.0</u>	<u>122</u>	<u>255</u>	<u>252</u>	<u>57</u>	<u>70</u>	<u>70</u>	
C-6	65	<u>586.80</u>	<u>0.80</u>	<u>1.50</u>		<u>2.5</u>	<u>122</u>	<u>256</u>	<u>251</u>	<u>59</u>	<u>70</u>	<u>70</u>	
	70	<u>590.00</u>	<u>0.75</u>	<u>1.45</u>		<u>2.5</u>	<u>122</u>	<u>255</u>	<u>256</u>	<u>58</u>	<u>70</u>	<u>70</u>	<u>18.1</u>
	75	<u>593.18</u>	<u>0.76</u>	<u>1.43</u>		<u>2.5</u>	<u>122</u>	<u>258</u>	<u>249</u>	<u>57</u>	<u>70</u>	<u>70</u>	<u>18.2</u>
	80	<u>596.41</u>	<u>0.75</u>	<u>1.41</u>		<u>2.5</u>	<u>122</u>	<u>255</u>	<u>257</u>	<u>57</u>	<u>70</u>	<u>70</u>	
	85	<u>599.40</u>	<u>0.61</u>	<u>1.15</u>		<u>2.0</u>	<u>121</u>	<u>254</u>	<u>249</u>	<u>58</u>	<u>71</u>	<u>71</u>	
	90	<u>602.23</u>	<u>0.62</u>	<u>1.17</u>		<u>2.0</u>	<u>122</u>	<u>255</u>	<u>257</u>	<u>59</u>	<u>71</u>	<u>71</u>	
D-6	95	<u>605.33</u>	<u>0.72</u>	<u>1.36</u>		<u>2.5</u>	<u>122</u>	<u>255</u>	<u>249</u>	<u>61</u>	<u>71</u>	<u>71</u>	
	100	<u>608.43</u>	<u>0.71</u>	<u>1.34</u>		<u>2.5</u>	<u>122</u>	<u>257</u>	<u>250</u>	<u>61</u>	<u>71</u>	<u>71</u>	
	105	<u>611.48</u>	<u>0.70</u>	<u>1.31</u>		<u>2.5</u>	<u>124</u>	<u>250</u>	<u>248</u>	<u>60</u>	<u>71</u>	<u>71</u>	
	110	<u>614.55</u>	<u>0.68</u>	<u>1.28</u>		<u>2.5</u>	<u>123</u>	<u>255</u>	<u>248</u>	<u>61</u>	<u>71</u>	<u>71</u>	
	115	<u>617.60</u>	<u>0.62</u>	<u>1.17</u>		<u>2.5</u>	<u>123</u>	<u>255</u>	<u>247</u>	<u>63</u>	<u>71</u>	<u>71</u>	
	120	<u>620.58</u>	<u>0.62</u>	<u>1.17</u>		<u>2.5</u>	<u>123</u>	<u>255</u>	<u>252</u>	<u>65</u>	<u>71</u>	<u>71</u>	
	<u>0=1042</u>	<u>vm=3.86</u>	<u>0.69</u>	<u>ΔH=1.29</u>			<u>Ts=122.50</u>					<u>Tm=69.54</u>	

Initialization Values			Test Run Times		ORSAT System		Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech. Date
Run 1	<u>67</u>	<u>18.7</u>	<u>12.9</u>	<u>1035</u>	<u>1242</u>			<u>2-6</u>			
Run 2											
										Nozzle No.	
										1	
										2	See Electronic Cal
										3	
										Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	<u>907</u>	<u>816.7</u>	<u>774.7</u>	<u>760.7</u>	<u>764.5</u>	<u>746.5</u>	<u>748.9</u>	<u>996.4</u>	
Initial wt., g	<u>758.8</u>	<u>768.9</u>	<u>763.9</u>	<u>755.8</u>	<u>762.0</u>	<u>746.1</u>	<u>742.4</u>	<u>978.4</u>	
Difference	<u>148.2</u>	<u>47.9</u>	<u>10.8</u>	<u>4.9</u>	<u>2.5</u>	<u>0.4</u>	<u>6.0</u>	<u>18.0</u>	<u>237.7</u>
1 N KCl			HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMNO <sub>4</sub>				

Air Flows	
ACFM	DSCFM
<u>182, 117</u>	<u>135, 204</u>

BARR

## ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArcelorMittal Minorca MineMeter ID C-14Probe ID 6-4Bar. Pres 28.25 in HgSmpl Loc Furnace Stack C SV016Meter Y 0.9831Pitot No. 6-4Stat. Pres -0.90 in H<sub>2</sub>OTest No. 1Run 3Orifice H@ 7.5315Pitot Cp 0.870.84Probe Lgth 6 ftDate 6-23-20Operators D. Koschak, M. NorstromLiner Type ☒ Glass ☐ S.S. ☐ OtherImp TC 6263

Sample Train Leak Rate (cfm)

Pretest 0.0 at 1.0 in HgPosttest 0.0 at 7 in HgPitot (3 in.) Pos Neg. 1

Sample Point	Sample Time Δt	Meter Volume vm, π	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	1311	620.79											
A-6	5	623.93	0.73	1.37		2.0	123	251	251	65	70	70	
	10	627.13	0.72	1.35		2.0	123	255	250	64	70	70	
	15	630.09	0.69	1.29		2.0	122	254	251	64	70	70	
	20	633.09	0.69	1.29		2.0	123	254	251	65	70	70	
	25	636.13	0.61	1.14		2.0	122	255	247	65	70	70	
	30	639.02	0.60	1.12		2.0	122	255	251	66	71	71	
B-6	35	642.32	0.79	1.48		2.5	122	256	251	66	71	71	
	40	645.55	0.74	1.39		2.5	122	255	249	59	71	71	
	45	648.81	0.74	1.39		2.5	122	255	247	58	71	71	
	50	652.02	0.75	1.41		2.5	123	255	248	58	72	72	
	55	655.14	0.65	1.22		2.0	122	255	253	57	72	72	
	60	658.19	0.66	1.24		2.0	122	254	242	58	72	72	
C-6	65	661.45	0.80	1.51		2.5	122	255	247	60	72	72	
	70	664.58	0.77	1.45		2.5	122	255	250	57	72	72	
	75	667.67	0.69	1.30		2.5	122	255	249	58	72	72	
	80	670.81	0.71	1.34		2.5	122	255	248	60	73	73	
	85	673.82	0.61	1.15		2.5	122	255	245	61	73	73	
	90	676.90	0.62	1.17		2.5	122	254	253	61	73	73	
D-6	95	679.96	0.70	1.32		2.5	122	256	249	64	73	73	
	100	683.21	0.70	1.32		2.5	122	255	250	62	73	73	
	105	686.06	0.65	1.23		2.5	122	255	252	62	73	73	
	110	689.10	0.62	1.24		2.5	124	255	250	63	74	74	
	115	692.06	0.58	1.10		2.5	122	255	251	64	74	74	
	120	695.04	0.57	1.07		2.5	123	255	251	63	74	74	
Σ		7425	0.68	ΔH=1.29			T <sub>s</sub> =222.24					T <sub>m</sub> =71.92	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	71	18.7	1311	1519	Stack C-3	106	0.0	C-3	Stack C-1	0.215	1	
Run 2											2	See Electronic Cal
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	924	792.2	817.4	760.3	770.2	772.4	768.5	986.6	
Initial wt., g	760.4	754.4	807.7	767.3	756.1	763.0	773	966.6	
Difference	163.5	237.8	109.7	93.6	114.1	109.4	95.5	20	220.8
	1 N KCl		HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>			H <sub>2</sub> SO <sub>4</sub> /KMnO <sub>4</sub>			

754.5 762.6 812.7 757.6 770.8 771.8 769.2 766.6

163.5

Air Flows	
ACFM	DSCFM
181,564	134,917



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 1

Project	ArcelorMittal			Meter ID	C-14	Probe ID	6-4	Bar.Press.	28.25	in. Hg	Sample Train Leak Rate, cfm:	
Sample Location	Indurating Furnace Stack C SV016			Meter Y	0.9831	Pitot Tube No.	6-4	Stat Press.	-0.9	in. H2O	Pretest	0.000 at 10 in. Hg
Date	06/23/20			Orifice dH@	2.0315	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 8 in. Hg
Test	1	Run #	1			Liner Type:	Glass	IMP Out TC	TIO-6268		Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN										Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	0808	471.22												
1	5.0	474.27	0.720	1.34	3.15	474.37	*	122	*	*	*	61	61	12.5
2	10.0	477.32	0.730	1.36	3.17	477.55	*	122	*	*	*	60	60	12.5
3	15.0	480.35	0.690	1.28	3.08	480.62	*	123	*	*	*	60	60	12.5
4	20.0	483.47	0.680	1.26	3.06	483.68	*	122	*	*	*	61	61	12.5
5	25.0	486.30	0.600	1.12	2.88	486.56	*	122	*	*	*	61	61	12.5
6	30.0	489.07	0.590	1.10	2.85	489.41	*	122	*	*	*	61	61	12.5
7	35.0	492.33	0.800	1.49	3.32	492.74	*	122	*	*	*	62	62	12.5
8	40.0	495.77	0.780	1.46	3.29	496.02	*	122	*	*	*	62	62	12.5
9	45.0	499.05	0.760	1.42	3.24	499.26	*	122	*	*	*	63	63	12.5
10	50.0	502.42	0.750	1.40	3.23	502.49	*	122	*	*	*	63	63	12.5
11	55.0	505.44	0.660	1.23	3.03	505.52	*	123	*	*	*	64	64	12.5
12	60.0	508.44	0.650	1.22	3.01	508.53	*	122	*	*	*	64	64	12.5
13	65.0	511.55	0.750	1.41	3.24	511.77	*	121	*	*	*	64	64	12.5
14	70.0	514.68	0.770	1.44	3.28	515.05	*	122	*	*	*	65	65	12.5
15	75.0	517.78	0.710	1.33	3.15	518.20	*	122	*	*	*	65	65	12.5
16	80.0	520.81	0.710	1.33	3.15	521.36	*	122	*	*	*	65	65	12.5
17	85.0	523.86	0.620	1.16	2.95	524.30	*	122	*	*	*	66	66	12.5
18	90.0	526.92	0.690	1.30	3.12	527.42	*	122	*	*	*	66	66	12.5
19	95.0	530.17	0.750	1.41	3.25	530.67	*	122	*	*	*	66	66	12.5
20	100.0	533.31	0.760	1.43	3.27	533.94	*	122	*	*	*	67	67	12.5
21	105.0	536.67	0.750	1.41	3.25	537.19	*	122	*	*	*	67	67	12.5
22	110.0	539.80	0.710	1.34	3.17	540.35	*	122	*	*	*	67	67	12.5
23	115.0	542.86	0.680	1.28	3.10	543.45	*	122	*	*	*	67	67	12.5
24	120.0	545.83	0.670	1.26	3.08	546.53	*	122	*	*	*	68	68	12.5
End Time	1015													
Run Time	120		Avg DH=	1.32			Avg Ts=	122.04				Avg Tm=	63.96	

Integrated Gas Sampling Data :

Bag No.	1
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	C-1
Nozzle No.	Stack C-1
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
916.9	801.7	815.4	768.5	758.0	762.4	773.3	966.6	
760.9	759.4	807.7	763.3	756.1	763.0	773.0	949.1	
156.0	42.3	7.7	5.2	1.9	-0.6	0.3	17.5	230.3

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 2

Project	ArcelorMittal			Meter ID	C-14	Probe ID	6-4	Bar.Press.	28.25	in. Hg	Sample Train Leak Rate, cfm:	
Sample Location	Indurating Furnace Stack C SV016			Meter Y	0.9831	Pitot Tube No.	6-4	Stat Press.	-0.9	in. H2O	Pretest	0.000 at 10 in. Hg
Date	06/23/20			Orifice dH@	2.0315	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 8 in. Hg
Test	1	Run #	2			Liner Type:	Glass	IMP Out TC	TIO-6268		Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN										Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1035	546.68												
1	5.0	549.95	0.710	1.33	3.15	549.83	*	122	*	*	*	67	67	12.9
2	10.0	552.92	0.710	1.32	3.15	552.98	*	124	*	*	*	68	68	12.9
3	15.0	556.01	0.660	1.23	3.04	556.03	*	124	*	*	*	67	67	12.9
4	20.0	559.02	0.660	1.23	3.04	559.06	*	124	*	*	*	68	68	12.9
5	25.0	562.05	0.620	1.16	2.95	562.01	*	123	*	*	*	68	68	12.9
6	30.0	564.96	0.610	1.14	2.93	564.94	*	123	*	*	*	68	68	12.9
7	35.0	568.21	0.800	1.50	3.35	568.30	*	122	*	*	*	68	68	12.9
8	40.0	571.43	0.780	1.46	3.31	571.61	*	122	*	*	*	69	69	12.9
9	45.0	574.67	0.710	1.33	3.17	574.77	*	122	*	*	*	69	69	12.9
10	50.0	577.72	0.700	1.31	3.14	577.92	*	122	*	*	*	69	69	12.9
11	55.0	580.71	0.610	1.14	2.94	580.85	*	122	*	*	*	70	70	12.9
12	60.0	583.58	0.590	1.11	2.89	583.75	*	122	*	*	*	70	70	12.9
13	65.0	586.80	0.800	1.50	3.37	587.11	*	122	*	*	*	70	70	12.9
14	70.0	590.00	0.770	1.45	3.30	590.42	*	122	*	*	*	70	70	12.9
15	75.0	593.18	0.760	1.43	3.28	593.70	*	122	*	*	*	70	70	12.9
16	80.0	596.41	0.750	1.41	3.26	596.96	*	122	*	*	*	70	70	12.9
17	85.0	599.40	0.610	1.15	2.94	599.90	*	121	*	*	*	71	71	12.9
18	90.0	602.23	0.620	1.17	2.97	602.87	*	122	*	*	*	71	71	12.9
19	95.0	605.33	0.720	1.36	3.20	606.07	*	122	*	*	*	71	71	12.9
20	100.0	608.43	0.710	1.34	3.18	609.25	*	122	*	*	*	71	71	12.9
21	105.0	611.48	0.700	1.31	3.15	612.40	*	124	*	*	*	71	71	12.9
22	110.0	614.55	0.680	1.28	3.11	615.51	*	123	*	*	*	71	71	12.9
23	115.0	617.60	0.620	1.17	2.97	618.48	*	123	*	*	*	71	71	12.9
24	120.0	620.54	0.620	1.17	2.97	621.45	*	123	*	*	*	71	71	12.9
End Time	1242													
Run Time	120		Avg DH=	1.29			Avg Ts=	122.50				Avg Tm=	69.54	

Integrated Gas Sampling Data :

Bag No.	2
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	2-C
Nozzle No.	Stack C-1
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
903.0	816.7	774.7	760.7	764.5	746.5	748.4	996.4	
758.8	768.8	763.9	755.8	762.0	746.1	742.4	978.4	
144.2	47.9	10.8	4.9	2.5	0.4	6.0	18.0	234.7

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 3

Project	ArcelorMittal	Meter ID	C-14	Probe ID	6-4	Bar.Press.	28.25	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Indurating Furnace Stack C SV016	Meter Y	0.9831	Pitot Tube No.	6-4	Stat Press.	-0.9	in. H2O	Pretest 0.000 at 10 in. Hg
Date	06/23/20	Orifice dH@	2.0315	Pitot Cp	0.84	CPM TC	NA	Posttest 0.000 at 7 in. Hg	
Test	1	Run #	3	Liner Type:	Glass	IMP Out TC	TIO-6268	Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN							Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1311	620.79												
1	5.0	623.93	0.730	1.37	3.21	624.00	*	123	*	*	*	70	70	13.1
2	10.0	627.13	0.720	1.35	3.19	627.19	*	123	*	*	*	70	70	13.1
3	15.0	630.09	0.690	1.29	3.12	630.31	*	122	*	*	*	70	70	13.1
4	20.0	633.09	0.690	1.29	3.12	633.43	*	123	*	*	*	70	70	13.1
5	25.0	636.13	0.610	1.14	2.94	636.37	*	122	*	*	*	70	70	13.1
6	30.0	639.02	0.600	1.12	2.91	639.28	*	122	*	*	*	71	71	13.1
7	35.0	642.32	0.790	1.48	3.35	642.63	*	122	*	*	*	71	71	13.1
8	40.0	645.55	0.740	1.39	3.24	645.87	*	122	*	*	*	71	71	13.1
9	45.0	648.81	0.740	1.39	3.24	649.11	*	122	*	*	*	71	71	13.1
10	50.0	652.02	0.750	1.41	3.26	652.37	*	123	*	*	*	72	72	13.1
11	55.0	655.14	0.650	1.22	3.04	655.41	*	122	*	*	*	72	72	13.1
12	60.0	658.19	0.660	1.24	3.07	658.48	*	122	*	*	*	72	72	13.1
13	65.0	661.45	0.800	1.51	3.37	661.85	*	122	*	*	*	72	72	13.1
14	70.0	664.58	0.770	1.45	3.31	665.16	*	122	*	*	*	72	72	13.1
15	75.0	667.67	0.690	1.30	3.13	668.29	*	122	*	*	*	72	72	13.1
16	80.0	670.81	0.710	1.34	3.18	671.47	*	122	*	*	*	73	73	13.1
17	85.0	673.82	0.610	1.15	2.95	674.43	*	122	*	*	*	73	73	13.1
18	90.0	676.90	0.620	1.17	2.98	677.41	*	122	*	*	*	73	73	13.1
19	95.0	679.96	0.700	1.32	3.16	680.57	*	122	*	*	*	73	73	13.1
20	100.0	683.21	0.700	1.32	3.16	683.73	*	122	*	*	*	73	73	13.1
21	105.0	686.06	0.650	1.23	3.05	686.78	*	122	*	*	*	73	73	13.1
22	110.0	689.10	0.660	1.24	3.07	689.85	*	124	*	*	*	74	74	13.1
23	115.0	692.06	0.580	1.10	2.89	692.73	*	122	*	*	*	74	74	13.1
24	120.0	695.04	0.570	1.07	2.86	695.59	*	123	*	*	*	74	74	13.1
End Time	1519													
Run Time	120		Avg DH=	1.29			Avg Ts=	122.29				Avg Tm=	71.92	

Integrated Gas Sampling Data :

Bag No.	3
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	C-3
Nozzle No.	Stack C-1
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
924.0	792.2	817.4	760.3	770.2	742.4	768.5	986.6	
754.5	762.6	812.7	757.6	770.8	741.8	769.2	966.6	
169.5	29.6	4.7	2.7	-0.6	0.6	-0.7	20.0	225.8

\* Data Recorded on Field Data Sheet



ONTARIO HYRDO D-6784-16 MERCURY TESTING  
IMPINGER RECOVERY

Project	ArcelorMittal Minorca Mine			Date 6/23/20				
Project No.	23692044.20			Operators	MJN	DJK	JAR2	BAW
Source	Furnace Stack C - SV016			Sample Location		Furnace Stack		
TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	916.9	801.7	815.4	768.5	758.0	762.4	773.3	966.6
Start	760.9	759.4	801.7	763.3	756.1	763.0	773.0	947.1
CHANGE	156.0	42.3	7.7	5.2	1.9	-0.6	0.3	17.5
MASS OF MOISTURE COLLECTED, g								230.3

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	903.0	816.7	774.7	760.7	764.5	746.5	748.1	976.4
Start	758.0	769.8	763.9	755.8	762.0	746.1	747.4	978.4
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	924.0	792.2	817.4	760.3	770.2	742.4	768.5	986.6
Start	754.5	762.6	812.7	757.6	770.8	741.8	769.2	966.6
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 4	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.								
END								
Start								

COMMENTS

**EPA METHOD 3A -- Instrument Analysis Data Sheet**

Project ArcelorMittal  
Sample Location(s): Indurating Furnace Stack C  
Test No: 1  
Date: 06/23/20  
Operators: JAR2

Analyzer Make / Model Servomex 1440  
Analyzer O<sub>2</sub> Range (span), %: 0- 22.5  
Analyzer CO<sub>2</sub> Range (span), %: 0- 9.5

**GAS CONCENTRATION AND IDENTIFICATION**

Calibration Level	Cylinder Serial No.		
		O <sub>2</sub> Cert. Conc.	CO <sub>2</sub> Cert. Conc.
Zero Gas	EB0098633	0.0	0.0
CO <sub>2</sub> Mid	EB0098397	---	4.9
O <sub>2</sub> Mid/CO <sub>2</sub> High	CC106732	9.5	9.5
O <sub>2</sub> High	EB0098397	22.5	---

**PRETEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5

Time of Calibration Start 1555  
Time of Calibration End 1615

**INTEGRATED BAG ANALYSIS**

Location/Test No.	Indurating Furnace Stack C		
Run No.	1	2	3
Time Sampled	1015	1242	1519
Time Analyzed	1607	1610	1612
O <sub>2</sub> , %	18.7	18.7	18.7
CO <sub>2</sub> , %	2.2	2.2	2.2

**POSTTEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5





0  
ONTARIO HYDR D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-14 Probe ID 6-4 Bar. Pres 28.23 in Hg  
Smpl Loc Furnace Stack D SV017 Meter Y 0.9831 Pitot No. 6-4 Stat. Pres -0.98 in H<sub>2</sub>O  
Test No. 1 Run 11 Orifice H@ 2.0315 Pitot Cp 0.84 Probe Lgth 6 ft  
Date 6-24-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 4444  
6268

Sample Train Leak Rate (cfm)		
Pretest	<u>0.2</u>	at <u>10</u> in Hg
Posttest	<u>0.6</u>	at <u>8</u> in Hg
Pitot (3 in.)	Pos <input checked="" type="checkbox"/>	Neg. <input checked="" type="checkbox"/>

Sample Point	Sample Time Δt	Meter Volume Vm, π'	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	<u>0810</u>	<u>695.25</u>											
A-6	5	<u>698.92</u>	<u>1.05</u>	<u>1.91</u>		<u>2.5</u>	<u>131</u>	<u>252</u>	<u>250</u>	<u>65</u>	<u>62</u>	<u>62</u>	
	10	<u>702.71</u>	<u>1.10</u>	<u>2.0</u>		<u>2.5</u>	<u>133</u>	<u>255</u>	<u>249</u>	<u>64</u>	<u>62</u>	<u>62</u>	
	15	<u>706.18</u>	<u>0.96</u>	<u>1.74</u>		<u>2.5</u>	<u>133</u>	<u>255</u>	<u>250</u>	<u>61</u>	<u>62</u>	<u>62</u>	
	20	<u>709.41</u>	<u>0.85</u>	<u>1.54</u>		<u>2.0</u>	<u>132</u>	<u>255</u>	<u>249</u>	<u>61</u>	<u>63</u>	<u>63</u>	
	25	<u>712.62</u>	<u>0.85</u>	<u>1.56</u>		<u>2.0</u>	<u>128</u>	<u>255</u>	<u>251</u>	<u>61</u>	<u>63</u>	<u>63</u>	
	30	<u>715.80</u>	<u>0.83</u>	<u>1.52</u>		<u>2.0</u>	<u>129</u>	<u>255</u>	<u>252</u>	<u>60</u>	<u>63</u>	<u>63</u>	
B-6	35	<u>719.58</u>	<u>0.99</u>	<u>1.81</u>		<u>2.5</u>	<u>128</u>	<u>254</u>	<u>257</u>	<u>62</u>	<u>63</u>	<u>63</u>	
	40	<u>723.18</u>	<u>0.94</u>	<u>1.77</u>		<u>2.5</u>	<u>137</u>	<u>255</u>	<u>248</u>	<u>62</u>	<u>63</u>	<u>63</u>	
	45	<u>726.71</u>	<u>0.93</u>	<u>1.68</u>		<u>2.5</u>	<u>137</u>	<u>255</u>	<u>251</u>	<u>63</u>	<u>64</u>	<u>64</u>	
	50	<u>730.14</u>	<u>0.93</u>	<u>1.68</u>		<u>2.5</u>	<u>136</u>	<u>255</u>	<u>242</u>	<u>64</u>	<u>64</u>	<u>64</u>	
	55	<u>733.53</u>	<u>0.82</u>	<u>1.49</u>		<u>2.5</u>	<u>136</u>	<u>250</u>	<u>251</u>	<u>64</u>	<u>64</u>	<u>64</u>	
	60	<u>736.82</u>	<u>0.80</u>	<u>1.45</u>		<u>2.5</u>	<u>135</u>	<u>251</u>	<u>254</u>	<u>64</u>	<u>64</u>	<u>64</u>	
C-6	65	<u>740.77</u>	<u>1.10</u>	<u>2.00</u>		<u>3.0</u>	<u>133</u>	<u>255</u>	<u>249</u>	<u>66</u>	<u>65</u>	<u>65</u>	
	70	<u>744.63</u>	<u>1.05</u>	<u>1.91</u>		<u>3.0</u>	<u>135</u>	<u>254</u>	<u>248</u>	<u>64</u>	<u>65</u>	<u>65</u>	
	75	<u>748.50</u>	<u>1.00</u>	<u>1.82</u>		<u>3.0</u>	<u>133</u>	<u>255</u>	<u>253</u>	<u>64</u>	<u>66</u>	<u>66</u>	
	80	<u>752.26</u>	<u>1.05</u>	<u>1.91</u>		<u>3.0</u>	<u>135</u>	<u>255</u>	<u>251</u>	<u>63</u>	<u>66</u>	<u>66</u>	
	85	<u>755.75</u>	<u>0.90</u>	<u>1.64</u>		<u>2.5</u>	<u>134</u>	<u>254</u>	<u>251</u>	<u>63</u>	<u>66</u>	<u>66</u>	
	90	<u>759.01</u>	<u>0.84</u>	<u>1.62</u>		<u>2.5</u>	<u>134</u>	<u>251</u>	<u>252</u>	<u>63</u>	<u>66</u>	<u>66</u>	
D-6	95	<u>763.40</u>	<u>1.10</u>	<u>2.02</u>		<u>3.0</u>	<u>131</u>	<u>256</u>	<u>248</u>	<u>65</u>	<u>67</u>	<u>67</u>	
	100	<u>766.93</u>	<u>1.10</u>	<u>2.01</u>		<u>3.0</u>	<u>134</u>	<u>255</u>	<u>251</u>	<u>62</u>	<u>67</u>	<u>67</u>	
	105	<u>770.87</u>	<u>1.10</u>	<u>2.02</u>		<u>3.0</u>	<u>132</u>	<u>255</u>	<u>250</u>	<u>64</u>	<u>67</u>	<u>67</u>	
	110	<u>774.67</u>	<u>1.05</u>	<u>1.92</u>		<u>3.0</u>	<u>133</u>	<u>255</u>	<u>251</u>	<u>64</u>	<u>67</u>	<u>67</u>	
	115	<u>778.31</u>	<u>0.98</u>	<u>1.80</u>		<u>3.0</u>	<u>130</u>	<u>255</u>	<u>255</u>	<u>64</u>	<u>67</u>	<u>67</u>	
	120	<u>781.82</u>	<u>0.94</u>	<u>1.73</u>		<u>3.0</u>	<u>129</u>	<u>254</u>	<u>248</u>	<u>64</u>	<u>68</u>	<u>68</u>	
	<u>07012</u>	<u>Vm 66.57</u>	<u>0.97</u>	<u>ΔH=1.72</u>			<u>Ts=132.83</u>					<u>Tm 64.75</u>	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	<u>61</u>	<u>18.3</u>	<u>13.0</u>	<u>0810</u>	<u>1016</u>	<u>SKALD-1</u>	<u>106</u>	<u>6.0</u>	<u>0-1</u>	<u>G-0-215</u>	<u>0.215</u>	
Run 2												
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	<u>927.2</u>	<u>871.5</u>	<u>778.4</u>	<u>763.1</u>	<u>720.0</u>	<u>765.6</u>	<u>757.4</u>	<u>1020.3</u>	
Initial wt., g	<u>261.6</u>	<u>264.0</u>	<u>267.8</u>	<u>259.8</u>	<u>219.9</u>	<u>264.3</u>	<u>258.0</u>	<u>996.4</u>	
Difference	<u>165.6</u>	<u>106.5</u>	<u>10.6</u>	<u>3.3</u>	<u>0.1</u>	<u>1.3</u>	<u>-0.6</u>	<u>23.9</u>	<u>312.7</u>
		1 N KCl		HNO3/H2O2		H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>219.345</u>	<u>155.597</u>



## ONTARIO HYRDO D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-14 Probe ID 6-4 Bar. Pres 28.23 in Hg  
Smpl Loc Furnace Stack D SV017 Meter Y 0.9831 Pitot No. 6-4 Stat. Pres 20.94 in H<sub>2</sub>O  
Test No. 1 Run 2 Orifice H@ 2.0315 Pitot Cp 0.84 Probe Lgth 6 ft  
Date 6-24-12 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 62608

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>8</u> in Hg
Pitot (3 in.) Pos.	<u>1</u>	Neg. <input checked="" type="checkbox"/>

Sample Point	Sample Time Δt	Meter Volume Vm, ft <sup>3</sup>	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
	1040	782.30											
A-6	5	786.14	1.10	1.94	2.5	2.5	135	254	250	62	67	67	
	10	790.00	1.15	2.02		2.5	134	258	249	56	68	68	
	15	793.85	1.15	2.03		2.5	134	256	249	56	68	68	
	20	797.57	1.15	2.03		2.5	134	255	251	57	68	68	
	25	800.94	0.91	1.61		2.5	132	255	250	57	68	68	
	30	804.33	0.91	1.61		2.5	130	254	250	59	68	68	
B-6	35	808.08	1.10	1.95		2.5	130	255	259	56	68	68	
	40	811.56	1.00	1.76		2.5	136	256	252	58	69	69	
	45	815.26	1.00	1.76		2.5	136	255	251	56	69	69	
	50	818.82	1.00	1.76		2.5	137	256	251	58	69	69	
	55	822.12	0.84	1.48		2.0	137	255	247	59	70	70	
	60	825.35	0.85	1.50		2.0	134	255	250	61	70	70	
C-6	65	829.00	1.00	1.78		2.5	132	256	252	63	70	70	
	70	832.67	0.98	1.72		2.5	138	255	252	62	71	71	
	75	836.10	0.96	1.69		2.5	138	257	251	65	71	71	
	80	839.68	0.98	1.73		2.5	137	255	251	65	72	72	
	85	842.45	0.78	1.38		2.5	136	255	245	65	72	72	
	90	846.23	0.80	1.41		2.5	137	255	248	66	72	72	
D-6	95	849.93	1.05	1.87		3.0	133	253	259	66	73	73	
	100	853.66	1.00	1.77		3.0	137	254	251	65	73	73	
	105	857.31	0.96	1.70		3.0	136	255	251	65	73	73	
	110	860.88	0.98	1.71		3.0	136	256	253	65	73	73	
	115	864.25	0.82	1.46		2.5	135	258	248	65	74	74	
	120	867.58	0.82	1.46		2.5	135	255	251	66	74	74	
Σ		Vm 85.28	0.97	ΔH=1.71			T <sub>s</sub> =135.17					T <sub>m</sub> =70.42	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	68	18.3	15	1040	1245	Stack D-2	100	0.0	D-2	Stack D-1	0.215	
Run 2												
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	952.2	827.8	818.5	761.3	750.0	760.3	771.3	933.1	
Initial wt., g	758.9	758.4	809.6	763.7	744.4	761.6	770.9	911.1	
Difference	193.4	69.4	6.9	-2.4	1.6	6.7	0.4	22.0	300.0
1 N KCl			HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMNO <sub>4</sub>				

Air Flows	
ACFM	DSCFM
219.325	155.342





## ONTARIO HYDRD D-6784-16 MERCURY TESTING

## FIELD DATA SHEET

Project ArecelorMittal Minorca Mine Meter ID C-14 Probe ID 6-4 Bar. Pres 28.23 in Hg  
Smpl Loc Furnace Stack D SV017 Meter Y 0.9831 Pitot No. 6-4 Stat. Pres 29.95 in H<sub>2</sub>O  
Test No. 1 Run 3 Orifice H@ 2.0315 Pitot Cp 0.84 Probe Lgth 6 ft  
Date 6-24-20 Operators D. Koschak, M. Norstrom Liner Type ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6268  
Sample Train Leak Rate (cfm)  
Pretest 0.0 at 10 in Hg  
Posttest 0.7 at 7 in Hg  
Pitot (3 in.) Pos ☐ Neg ☒

Sample Point	Sample Time Δt	Meter Volume Vm, ft <sup>3</sup>	Velocity ΔP, in H <sub>2</sub> O	Orifice ΔH, in H <sub>2</sub> O	Ideal Meter Volume	Sample Vacuum, in Hg	Stack Temp. t <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		862.80											
A-6	5	871.42	1.00	1.88	2	2.0	136	255	248	63	74	74	
	10	875.05	1.00	1.78		2.0	135	255	254	58	74	74	
	15	878.54	0.97	1.73		2.0	135	256	254	59	74	74	
	20	882.15	0.96	1.72		2.0	132	255	251	61	74	74	
	25	885.46	0.78	1.39		2.0	133	255	251	62	74	74	
	30	888.58	0.78	1.39		2.0	133	255	251	63	74	74	
B-6	35	892.45	1.10	1.96		2.5	134	254	244	64	74	74	
	40	896.17	1.00	1.78		2.5	134	256	251	64	74	74	
	45	899.63	0.95	1.68		2.5	137	256	250	64	74	74	
	50	903.03	0.95	1.68		2.5	138	255	248	65	75	75	
	55	906.43	0.74	1.32		2.0	138	255	247	63	75	75	
	60	909.61	0.81	1.44		2.0	132	255	254	62	75	75	
C-6	65	913.31	1.00	1.78		2.5	136	256	251	61	75	75	
	70	916.91	1.00	1.78		2.5	137	255	252	59	75	75	
	75	920.44	0.94	1.67		2.5	137	255	251	60	75	75	
	80	923.95	0.97	1.72		2.5	138	255	247	61	76	76	
	85	927.41	0.85	1.51		2.5	137	256	249	63	76	76	
	90	930.68	0.84	1.53		2.5	137	255	248	64	76	76	
D-6	95	934.55	1.10	1.96		3.0	138	256	252	66	76	76	
	100	938.38	1.05	1.87		3.0	136	255	244	64	76	76	
	105	942.27	1.00	1.78		3.0	137	254	244	65	76	76	
	110	946.03	1.00	1.96		3.0	135	255	251	66	77	77	
	115	949.55	0.89	1.59		2.5	135	255	249	63	77	77	
	120	953.00	0.89	1.59		2.5	135	255	248	61	77	77	
Σ=		Vm=85.20	0.95	ΔH=1.69			Ts=35.71					Tm=75.13	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
Run 1	74	18.3	15	1300	1506	Stack D-3	102	0.0	D-3	Stack D-1	0.215	
Run 2												
											Avg. in.	

Moisture Recovery Data and impinger content information:

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	944.0	853.8	776.2	770.0	724.6	762.4	753.0	921.0	
Initial wt., g	767.7	771.3	777.5	765.2	722.9	763.5	754.0	896.5	
Difference	176.3	82.5	8.7	4.8	1.7	-1.1	-1.0	24.5	296.4
1 N KCl			HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub> /KMnO <sub>4</sub>				

Air Flows	
ACFM	DSCFM
210922	153481



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 1

Project	ArcelorMittal	Meter ID	C-14	Probe ID	6-4	Bar.Press.	28.23	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Indurating Furnace Stack D SV017	Meter Y	0.9831	Pitot Tube No.	6-4	Stat Press.	-0.9	in. H2O	Pretest 0.000 at 10 in. Hg
Date	06/24/20	Orifice dH@	2.0315	Pitot Cp	0.84	CPM TC	NA	Posttest 0.000 at 8 in. Hg	
Test	1	Run #	1	Liner Type:	Glass	IMP Out TC	TIO-6268	Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN							Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	0810	695.25												
1	5.0	698.92	1.050	1.91	3.75	699.00	*	131	*	*	*	62	62	13.0
2	10.0	702.71	1.100	2.00	3.84	702.84	*	133	*	*	*	62	62	13.0
3	15.0	706.18	0.960	1.74	3.59	706.43	*	133	*	*	*	62	62	13.0
4	20.0	709.41	0.850	1.54	3.38	709.81	*	132	*	*	*	63	63	13.0
5	25.0	712.62	0.850	1.56	3.40	713.22	*	128	*	*	*	63	63	13.0
6	30.0	715.80	0.830	1.52	3.36	716.57	*	129	*	*	*	63	63	13.0
7	35.0	719.58	0.990	1.81	3.67	720.24	*	128	*	*	*	63	63	13.0
8	40.0	723.18	0.980	1.77	3.62	723.86	*	137	*	*	*	63	63	13.0
9	45.0	726.71	0.930	1.68	3.53	727.39	*	137	*	*	*	64	64	13.0
10	50.0	730.14	0.930	1.68	3.54	730.93	*	136	*	*	*	64	64	13.0
11	55.0	733.53	0.820	1.49	3.32	734.25	*	136	*	*	*	64	64	13.0
12	60.0	736.82	0.800	1.45	3.29	737.54	*	135	*	*	*	64	64	13.0
13	65.0	740.77	1.100	2.00	3.85	741.40	*	133	*	*	*	65	65	13.0
14	70.0	744.63	1.050	1.91	3.77	745.16	*	135	*	*	*	65	65	13.0
15	75.0	748.50	1.000	1.82	3.68	748.85	*	133	*	*	*	66	66	13.0
16	80.0	752.26	1.050	1.91	3.78	752.62	*	135	*	*	*	66	66	13.0
17	85.0	755.75	0.900	1.64	3.50	756.12	*	134	*	*	*	66	66	13.0
18	90.0	759.01	0.890	1.62	3.48	759.61	*	134	*	*	*	66	66	13.0
19	95.0	763.00	1.100	2.02	3.88	763.48	*	131	*	*	*	67	67	13.0
20	100.0	766.93	1.100	2.01	3.87	767.35	*	134	*	*	*	67	67	13.0
21	105.0	770.80	1.100	2.02	3.88	771.23	*	132	*	*	*	67	67	13.0
22	110.0	774.67	1.050	1.92	3.79	775.02	*	133	*	*	*	67	67	13.0
23	115.0	778.31	0.980	1.80	3.67	778.69	*	130	*	*	*	67	67	13.0
24	120.0	781.82	0.940	1.73	3.60	782.29	*	129	*	*	*	68	68	13.0
End Time	1016													
Run Time	120		Avg DH=	1.77			Avg Ts=	132.83				Avg Tm=	64.75	

Integrated Gas Sampling Data:

Bag No.	NA
Bag Vol.	NA liters
Leak Rate	NA cc/min

Filter No.	D-1
Nozzle No.	Stack D-1
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA:

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
927.2	877.5	778.4	763.1	720.0	765.6	757.4	1020.3	
761.6	769.0	767.8	759.8	719.9	764.3	758.0	996.4	
165.6	108.5	10.6	3.3	0.1	1.3	-0.6	23.9	312.7

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 2

Project	ArcelorMittal		Meter ID	C-14	Probe ID	6-4	Bar.Press.	28.23	in. Hg	Sample Train Leak Rate, cfm:		
Sample Location	Indurating Furnace Stack D SV017		Meter Y	0.9831	Pitot Tube No.	6-4	Stat Press.	-0.9	in. H2O	Pretest	0.000	at 10 in. Hg
Date	06/24/20		Orifice dH@	2.0315	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000	at 8 in. Hg
Test	1	Run #	2		Liner Type:	Glass	IMP Out TC	TIO-6268		Pretest Pitot leak Check Pos	PASS	@ >3" w.c
Operators	DJK /MJN									Posttest Pitot leak Check Neg	PASS	@ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1040	782.30												
1	5.0	786.14	1.100	1.94	3.80	786.10	*	135	*	*	*	67	67	15.0
2	10.0	790.00	1.150	2.02	3.89	789.99	*	134	*	*	*	68	68	15.0
3	15.0	793.85	1.150	2.03	3.89	793.88	*	134	*	*	*	68	68	15.0
4	20.0	797.57	1.150	2.03	3.89	797.78	*	134	*	*	*	68	68	15.0
5	25.0	800.94	0.910	1.61	3.47	801.25	*	132	*	*	*	68	68	15.0
6	30.0	804.33	0.910	1.61	3.48	804.73	*	130	*	*	*	68	68	15.0
7	35.0	808.08	1.100	1.95	3.82	808.55	*	130	*	*	*	68	68	15.0
8	40.0	811.56	1.000	1.76	3.63	812.17	*	136	*	*	*	69	69	15.0
9	45.0	815.26	1.000	1.76	3.63	815.81	*	136	*	*	*	69	69	15.0
10	50.0	818.82	1.000	1.76	3.63	819.44	*	137	*	*	*	69	69	15.0
11	55.0	822.12	0.840	1.48	3.33	822.76	*	137	*	*	*	70	70	15.0
12	60.0	825.35	0.850	1.50	3.36	826.13	*	134	*	*	*	70	70	15.0
13	65.0	829.00	1.000	1.76	3.64	829.77	*	137	*	*	*	70	70	15.0
14	70.0	832.67	0.980	1.72	3.60	833.36	*	138	*	*	*	71	71	15.0
15	75.0	836.10	0.960	1.69	3.57	836.93	*	138	*	*	*	71	71	15.0
16	80.0	839.68	0.980	1.73	3.61	840.54	*	137	*	*	*	72	72	15.0
17	85.0	842.95	0.780	1.38	3.23	843.77	*	136	*	*	*	72	72	15.0
18	90.0	846.23	0.800	1.41	3.27	847.04	*	137	*	*	*	72	72	15.0
19	95.0	849.93	1.050	1.87	3.75	850.79	*	133	*	*	*	73	73	15.0
20	100.0	853.66	1.000	1.77	3.66	854.45	*	137	*	*	*	73	73	15.0
21	105.0	857.31	0.960	1.70	3.59	858.03	*	136	*	*	*	73	73	15.0
22	110.0	860.88	0.980	1.74	3.62	861.66	*	136	*	*	*	73	73	15.0
23	115.0	864.25	0.820	1.46	3.32	864.98	*	135	*	*	*	74	74	15.0
24	120.0	867.58	0.820	1.46	3.33	868.30	*	135	*	*	*	74	74	15.0
End Time	1245													
Run Time	120		Avg DH=	1.71			Avg Ts=	135.17				Avg Tm=	70.42	

Integrated Gas Sampling Data :

Bag No.	2
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	D-2
Nozzle No.	Stack D-1
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
952.2	827.8	818.5	761.3	750.0	768.5	771.3	933.1	
758.8	758.4	809.6	763.7	748.4	761.8	770.9	911.1	
193.4	69.4	8.9	-2.4	1.6	6.7	0.4	22.0	300.0

\* Data Recorded on Field Data Sheet



## Ontario Hydro ASTM D6784 - Field Data Sheet - Run 3

Project	ArcelorMittal	Meter ID	C-14	Probe ID	6-4	Bar.Press.	28.23	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Indurating Furnace Stack D SV017	Meter Y	0.9831	Pitot Tube No.	6-4	Stat Press.	-0.9	in. H2O	Pretest 0.000 at 10 in. Hg
Date	06/24/20	Orifice dH@	2.0315	Pitot Cp	0.84	CPM TC	NA	Posttest 0.000 at 7 in. Hg	
Test	1	Run #	3	Liner Type:	Glass	IMP Out TC	TIO-6268	Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	DJK /MJN							Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					Moisture Content, %
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1300	867.80												
1	5.0	871.42	1.000	1.78	3.67	871.47	*	136	*	*	*	74	74	15.0
2	10.0	875.05	1.000	1.78	3.67	875.14	*	135	*	*	*	74	74	15.0
3	15.0	878.54	0.970	1.73	3.62	878.75	*	135	*	*	*	74	74	15.0
4	20.0	882.15	0.960	1.72	3.61	882.36	*	132	*	*	*	74	74	15.0
5	25.0	885.46	0.780	1.39	3.25	885.61	*	133	*	*	*	74	74	15.0
6	30.0	888.58	0.780	1.39	3.25	888.86	*	133	*	*	*	74	74	15.0
7	35.0	892.45	1.100	1.96	3.85	892.71	*	134	*	*	*	74	74	15.0
8	40.0	896.17	1.000	1.78	3.67	896.38	*	134	*	*	*	74	74	15.0
9	45.0	899.63	0.950	1.68	3.57	899.96	*	137	*	*	*	74	74	15.0
10	50.0	903.07	0.950	1.68	3.57	903.53	*	138	*	*	*	75	75	15.0
11	55.0	906.43	0.780	1.38	3.24	906.77	*	138	*	*	*	75	75	15.0
12	60.0	909.61	0.810	1.44	3.31	910.08	*	137	*	*	*	75	75	15.0
13	65.0	913.31	1.000	1.78	3.67	913.75	*	136	*	*	*	75	75	15.0
14	70.0	916.91	1.000	1.78	3.67	917.42	*	137	*	*	*	75	75	15.0
15	75.0	920.44	0.940	1.67	3.56	920.98	*	137	*	*	*	75	75	15.0
16	80.0	923.95	0.970	1.72	3.61	924.59	*	138	*	*	*	76	76	15.0
17	85.0	927.41	0.850	1.51	3.39	927.99	*	137	*	*	*	76	76	15.0
18	90.0	930.68	0.860	1.53	3.41	931.40	*	137	*	*	*	76	76	15.0
19	95.0	934.55	1.100	1.96	3.86	935.26	*	135	*	*	*	76	76	15.0
20	100.0	938.38	1.050	1.87	3.77	939.03	*	136	*	*	*	76	76	15.0
21	105.0	942.27	1.000	1.78	3.68	942.71	*	137	*	*	*	76	76	15.0
22	110.0	946.03	1.100	1.96	3.86	946.57	*	135	*	*	*	77	77	15.0
23	115.0	949.55	0.890	1.59	3.48	950.06	*	135	*	*	*	77	77	15.0
24	120.0	953.00	0.890	1.59	3.48	953.54	*	135	*	*	*	77	77	15.0
End Time	1506													
Run Time	120		Avg DH=	1.69			Avg Ts=	135.71				Avg Tm=	75.13	

Integrated Gas Sampling Data :

Bag No.	3
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	D-3
Nozzle No.	Stack D-1
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	6	7	Desiccant	Total
944.0	853.8	776.2	770.0	724.6	762.4	753.0	921.0	
767.7	771.3	767.5	765.2	722.9	763.5	754.0	896.5	
176.3	82.5	8.7	4.8	1.7	-1.1	-1.0	24.5	296.4

\* Data Recorded on Field Data Sheet



D

D

**ONTARIO HYRDO D-6784-16 MERCURY TESTING  
IMPINGER RECOVERY**

Project	ArcelorMittal Minorca Mine			Date	6/24/20			
Project No.	23692044.20			Operators	MJN	DJK	JAR2	BAW
Source	Furnace Stack D - SV017			Sample Location	Furnace Stack			
TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END								
Start	<del>903.0</del>	<del>816.7</del>	<del>774.7</del>	<del>760.7</del>	<del>746.5</del>	<del>764.5</del>	<del>748.1</del>	<del>996.4</del>
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 21	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	927.2	877.5	778.4	763.1	720.0	765.6	757.4	1020.3
Start	761.6	769.0	767.8	759.8	719.9	764.3	759.0	996.4
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 22	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
END	952.2	827.8	818.5	750.0	761.3	768.5	771.3	933.1
Start	758.8	758.4	809.6	763.7	748.4	761.8	770.9	911.1
CHANGE								
MASS OF MOISTURE COLLECTED, g								

TEST RUN 23	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	944.0	853.8	776.2	770.0	724.6	762.4	753.0	921.0
END	767.7	771.3	767.5	765.2	722.9	763.5	754.0	896.5
Start								

COMMENTS



**EPA METHOD 3A -- Instrument Analysis Data Sheet**

Project	ArcelorMittal
Sample Location(s):	Indurating Furnace Stack D
Test No:	1
Date:	06/24/20
Operators:	JAR2

Analyzer Make / Model	Servomex 1440
Analyzer O <sub>2</sub> Range (span), %:	0- 22.5
Analyzer CO <sub>2</sub> Range (span), %:	0- 9.5

**GAS CONCENTRATION AND IDENTIFICATION**

Calibration Level	Cylinder Serial No.		
		O <sub>2</sub> Cert. Conc.	CO <sub>2</sub> Cert. Conc.
Zero Gas	EB0098633	0.0	0.0
CO <sub>2</sub> Mid	EB0098397	---	4.9
O <sub>2</sub> Mid/CO <sub>2</sub> High	CC106732	9.5	9.5
O <sub>2</sub> High	EB0098397	22.5	---

**PRETEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5

Time of Calibration Start	1535
Time of Calibration End	1605

**INTEGRATED BAG ANALYSIS**

Location/Test No.	Indurating Furnace Stack D		
Run No.	1	2	3
Time Sampled	1016	1245	1506
Time Analyzed	1552	1555	1559
O <sub>2</sub> , %	18.3	18.3	18.3
CO <sub>2</sub> , %	2.6	2.6	2.6

**POSTTEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.1	0.0	0.0
Mid-Gas:	9.5	9.5	4.9	5.0
High-Gas:	22.5	22.5	9.5	9.5

## **Appendix C**

### **Laboratory Reports and Sample Chain of Custody**

Ontario Hydro Laboratory Results Summary  
Indurating Furnace Stack A (SV014)

Run Number	Average Total Catch		Filter	FH Rinse	KCL	HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>	KMnO <sub>4</sub>
		ug	ug	ug	ug	ug	ug
1	#1	3.33	0.015	0.011	0.748	0.030	2.57
	#2		0.014	0.011	0.747	0.027	2.58
	Average Per Fraction		0.015	0.011	0.748	0.029	2.58
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.015</b>	<b>0.011</b>	<b>0.748</b>	<b>0.023</b>	<b>2.535</b>
2	#1	3.23	0.051	0.014	0.825	0.013	2.40
	#2		0.050	0.013	0.785	0.013	2.39
	Average Per Fraction		0.051	0.014	0.805	0.013	2.40
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.051</b>	<b>0.014</b>	<b>0.805</b>	<b>0.008</b>	<b>2.36</b>
3	#1	3.38	0.087	0.016	0.995	0.029	2.23
	#2		0.083	0.016	1.02	0.028	2.34
	Average Per Fraction		0.085	0.016	1.008	0.029	2.29
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.085</b>	<b>0.016</b>	<b>1.008</b>	<b>0.023</b>	<b>2.25</b>
Field Blank Results			< 0.005	< 0.004	< 0.007	0.005	0.008
			< 0.005	< 0.004	< 0.007	0.005	0.007
Average			< 0.005	< 0.004	< 0.007	0.005	0.008
Volume analyzed, mls			-	82	130	96	45
Volume loaded				NA	NA	100	300
Correction per run,vol adjusted						0.005	0.050
10X Instrument det limit						0.040	0.040

1. Blank correction limited to 10% of sample mass or 10X instrument detection limit whichever is less

Ontario Hydro Laboratory Results Summary  
Indurating Furnace Stack B (SV015)

Run Number	Average Total Catch		Filter	FH Rinse	KCL	HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>	KMnO <sub>4</sub>
		ug	ug	ug	ug	ug	ug
1	#1	4.49	0.094	0.024	1.16	0.017	3.26
	#2		0.089	0.024	1.14	0.018	3.25
	Average Per Fraction		0.092	0.024	1.150	0.018	3.26
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.092</b>	<b>0.024</b>	<b>1.150</b>	<b>0.012</b>	<b>3.215</b>
2	#1	4.21	0.006	0.020	1.04	0.021	3.17
	#2		0.006	0.020	1.01	0.020	3.19
	Average Per Fraction		0.006	0.020	1.025	0.021	3.18
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.006</b>	<b>0.020</b>	<b>1.025</b>	<b>0.015</b>	<b>3.14</b>
3	#1	4.18	0.146	0.032	0.970	0.018	3.06
	#2		0.142	0.030	0.929	0.018	3.10
	Average Per Fraction		0.144	0.031	0.950	0.018	3.08
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.144</b>	<b>0.031</b>	<b>0.950</b>	<b>0.013</b>	<b>3.04</b>
Field Blank Results			< 0.005	< 0.004	< 0.007	0.005	0.008
			< 0.005	< 0.004	< 0.007	0.005	0.007
Average			< 0.005	< 0.004	< 0.007	0.005	0.008
Volume analyzed, mls			-	82	130	96	45
Volume loaded				NA	NA	100	300
Correction per run,vol adjusted						0.005	0.050
10X Instrument det limit						0.040	0.040

1. Blank correction limited to 10% of sample mass or 10X instrument detection limit whichever is less

Ontario Hydro Laboratory Results Summary  
Indurating Furnace Stack C (SV016)

Run Number	Average Total Catch		Filter ug	FH Rinse ug	KCL ug	HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> ug	KMnO <sub>4</sub> ug
		ug					
1	#1	5.49	0.303	< 0.01	0.463	0.014	4.81
	#2		0.309	< 0.01	0.472	0.015	4.66
	Average Per Fraction		0.306	< 0.01	0.468	0.015	4.74
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.306</b>	<b>&lt; 0.01</b>	<b>0.468</b>	<b>0.009</b>	<b>4.70</b>
2	#1	4.99	< 0.005	< 0.01	0.473	0.019	4.52
	#2		< 0.005	< 0.01	0.461	0.018	4.54
	Average Per Fraction		< 0.005	< 0.01	0.467	0.019	4.53
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>&lt; 0.005</b>	<b>&lt; 0.010</b>	<b>0.467</b>	<b>0.013</b>	<b>4.49</b>
3	#1	5.64	< 0.005	0.018	1.20	0.039	4.47
	#2		< 0.005	0.017	1.18	0.038	4.40
	Average Per Fraction		< 0.005	0.018	1.190	0.039	4.44
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>&lt; 0.005</b>	<b>0.018</b>	<b>1.190</b>	<b>0.033</b>	<b>4.40</b>
Field Blank Results			< 0.005	< 0.004	< 0.007	0.005	0.008
			< 0.005	< 0.004	< 0.007	0.005	0.007
Average			< 0.005	< 0.004	< 0.007	0.005	0.008
Volume analyzed, mls			-	82	130	96	45
Volume loaded				NA	NA	100	300
Correction per run, vol adjusted						0.005	0.050
10X Instrument det limit						0.040	0.040

1. Blank correction limited to 10% of sample mass or 10X instrument detection limit whichever is less

Ontario Hydro Laboratory Results Summary  
Indurating Furnace Stack D (SV017)

Run Number	Average Total Catch		Filter	FH Rinse	KCL	HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub>	KMnO <sub>4</sub>
		ug	ug	ug	ug	ug	ug
1	#1	10.40	0.009	0.018	1.46	0.051	8.86
	#2		0.008	0.019	1.54	0.055	8.88
	Average Per Fraction		0.009	0.019	1.50	0.053	8.87
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.009</b>	<b>0.019</b>	<b>1.50</b>	<b>0.048</b>	<b>8.83</b>
2	#1	9.42	0.042	0.024	1.35	0.037	8.03
	#2		0.042	0.024	1.31	0.037	8.03
	Average Per Fraction		0.042	0.024	1.330	0.037	8.03
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.042</b>	<b>0.024</b>	<b>1.330</b>	<b>0.032</b>	<b>7.99</b>
3	#1	9.68	0.006	0.018	1.68	0.036	7.99
	#2		0.007	0.018	1.70	0.037	7.96
	Average Per Fraction		0.007	0.018	1.69	0.037	7.98
	Blank Correction <sup>1</sup>		na	na	na	0.005	0.040
	Blank Corrected Results		<b>0.007</b>	<b>0.018</b>	<b>1.69</b>	<b>0.031</b>	<b>7.94</b>
Field Blank Results			< 0.005	< 0.004	< 0.007	0.005	0.008
			< 0.005	< 0.004	< 0.007	0.005	0.007
Average			< 0.005	< 0.004	< 0.007	0.005	0.008
Volume analyzed, mls			-	82	130	96	45
Volume loaded				NA	NA	100	300
Correction per run, vol adjusted						0.005	0.050
10X Instrument det limit						0.040	0.040

1. Blank correction limited to 10% of sample mass or 10X instrument detection limit whichever is less

# **Barr Engineering**

3128 14<sup>th</sup> Avenue East  
Hibbing, MN 55746

Project Number: 23/69-2044.20 100 200

Mercury

Ontario Hydro Method Analysis

Analytical Report  
35042



Element One, Inc.

6319-D Carolina Beach Rd., Wilmington, NC 28412

910-793-0128 FAX:910-792-6853 [e1lab@e1lab.com](mailto:e1lab@e1lab.com)

The following data for Analytical Report 35042  
has been reviewed for completeness, accuracy,  
adherence to method protocol,  
and compliance with quality assurance guidelines.

Review by:

A handwritten signature in black ink, appearing to read 'Katie Gattis', with a long horizontal flourish extending to the right.

Katie Gattis, Quality Assurance Officer  
July 16, 2020

Report Reviewed and Finalized By:

A handwritten signature in black ink, appearing to read 'Ken Smith', with a long horizontal flourish extending to the right.

Ken Smith, Laboratory Director  
July 16, 2020



# SUMMARY OF RESULTS

## Summary of Analysis

### Summary of OHM Mercury Analysis

Run Number		Average Total Catch, µg	Filter µg	FH Rinse µg	KCl µg	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub> µg	KMnO <sub>4</sub> µg
-----	----	-----	-----	-----	-----	-----	-----
SV014-OHM-R1	# 1	3.38	0.015	0.011	0.748	0.030	2.57
	# 2		0.014	0.011	0.747	0.027	2.58
SV014-OHM-R2	# 1	3.28	0.051	0.014	0.825	0.013	2.40
	# 2		0.050	0.013	0.785	0.013	2.39
SV014-OHM-R3	# 1	3.42	0.087	0.016	0.995	0.029	2.23
	# 2		0.083	0.016	1.02	0.028	2.34
SV015-OHM-R1	# 1	4.54	0.094	0.024	1.16	0.017	3.26
	# 2		0.089	0.024	1.14	0.018	3.25
SV015-OHM-R2	# 1	4.25	0.006	0.020	1.04	0.021	3.17
	# 2		0.006	0.020	1.01	0.020	3.19
SV015-OHM-R3	# 1	4.22	0.146	0.032	0.970	0.018	3.06
	# 2		0.142	0.030	0.929	0.018	3.10
SV016-OHM-R1	# 1	5.53	0.303	< 0.01	0.463	0.014	4.81
	# 2		0.309	< 0.01	0.472	0.015	4.66
SV016-OHM-R2	# 1	5.01	< 0.005	< 0.01	0.473	0.019	4.52
	# 2		< 0.005	< 0.01	0.461	0.018	4.54
SV016-OHM-R3	# 1	5.68	< 0.005	0.018	1.20	0.039	4.47
	# 2		< 0.005	0.017	1.18	0.038	4.40
SV017-OHM-R1	# 1	10.5	0.009	0.018	1.46	0.051	8.86
	# 2		0.008	0.019	1.54	0.055	8.88
SV017-OHM-R2	# 1	9.46	0.042	0.024	1.35	0.037	8.03
	# 2		0.042	0.024	1.31	0.037	8.03
SV017-OHM-R3	# 1	9.73	0.006	0.018	1.68	0.036	7.99
	# 2		0.007	0.018	1.70	0.037	7.96
Train Blank	# 1	< 0.03	---	---	< 0.025	< 0.013	< 0.03
	# 2		---	---	< 0.025	< 0.013	< 0.03

### Reagent Blank Summary of OHM Mercury Analysis

Run Number		Filter µg	FH Rinse µg	KCl µg	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub> µg	KMnO <sub>4</sub> µg	Hydroxylamine Hydrochloride µg
-----	----	-----	-----	-----	-----	-----	-----
Reagent Blank	#1	< 0.005	< 0.004	< 0.007	0.005	0.008	0.036
	#2	< 0.005	< 0.004	< 0.007	0.005	0.007	0.036

# ANALYTICAL NARRATIVE

## Element One Analytical Narrative

Client:	Barr Engineering	Element One #:	35042
Client ID:	23/69-2044.20 100 200	Analyst:	TAD
Method:	OHM	Dates Received:	06/30-07/01/20
Analytes:	Hg	Dates Analyzed:	07/07-16/20

### Summary of Analysis

The Ontario Hydro Method (OHM) samples were prepared and analyzed according to method protocol. Samples were analyzed for mercury on a PS Analytical Millennium Galahad analyzer and PerkinElmer FIMS-100 CVAA mercury analyzer.

### Ontario Hydro Mercury Catch Summary

The Ontario Hydro Method employs five different fractions to collect mercury in its various states in a flue gas stream. Particle-bound mercury is collected in the filter and front-half rinse. Oxidized mercury ( $\text{Hg}_2^{2+}$  and  $\text{Hg}^{2+}$ ) is collected in the potassium chloride (KCl) fraction. The acidified hydrogen peroxide ( $\text{H}_2\text{O}_2/\text{HNO}_3$ ) and potassium permanganate ( $\text{KMnO}_4$ ) fractions are utilized to collect elemental mercury ( $\text{Hg}^0$ ). Total mercury refers to all mercury, however generated or entrained, in the flue gas stream.

### Detection Limits

The Ontario Hydro Method Millennium Galahad CVAF instrument reporting limit for mercury was 0.001  $\mu\text{g}$  per aliquot analyzed, which is 0.05  $\mu\text{g/L}$  for a 20 ml aliquot. The FIMS-100 CVAA instrument reporting limit for mercury was 0.004  $\mu\text{g}$  per aliquot analyzed.

### Analysis QA/QC

Duplicate analyses relative percent difference (RPD), triplicate analysis relative standard deviation (RSD), and spike sample recovery are summarized in the Quality Control Section.

\*Ref. page 9; the mercury spike recoveries for sample SV016-R3 filter were outside of laboratory guidelines of 85-115% at a one-fold dilution with 76% and 77%. Sample was reanalyzed resulting in acceptable recoveries of 90% and 88% at a four-fold dilution. Spike recoveries for  $\text{KMnO}_4$  samples SV015-R3 and SV016-R3 were also outside of QA/QC guidelines at a one-fold dilution with 57%, 56% and 63%, 64%, respectively. Samples were reanalyzed at a two-fold dilution resulting in acceptable recoveries of 94%, 95% for SV015-R3 and 93%, 91% for SV016-R3.

All other QA/QC data was within the criteria of the method.

### Additional Comments

The reported results have not been corrected for any blank values or spike recovery values. The reported results relate only to the items tested or calibrated.

Analysis of the acidified peroxide,  $\text{KMnO}_4$  and hydroxylamine reagent blank fractions revealed detectable traces of mercury. Samples were reanalyzed to verify results.

# QUALITY CONTROL SUMMARY

## Summary of Quality Control Data

### Mercury Duplicate Analysis RPD

(OHM QC limits:  $\leq 10\%$  for RPD)

Run Number	Filter	FH Rinse	KCl	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	KMnO <sub>4</sub>
SV014-OHM-R1	6.2%	1.9%	0.2%	9.8%	0.4%
SV014-OHM-R2	1.6%	5.1%	5.0%	3.9%	0.5%
SV014-OHM-R3	4.3%	1.2%	2.8%	3.6%	4.9%
SV015-OHM-R1	5.7%	2.5%	1.0%	5.9%	0.2%
SV015-OHM-R2	3.5%	1.0%	3.4%	5.0%	0.7%
SV015-OHM-R3	3.1%	4.5%	4.3%	3.9%	1.1%
SV016-OHM-R1	2.2%	NA	1.9%	6.3%	3.2%
SV016-OHM-R2	NA	NA	2.6%	1.6%	0.5%
SV016-OHM-R3	NA	1.1%	1.4%	2.6%	1.5%
SV017-OHM-R1	6.9%	1.6%	4.8%	6.0%	0.2%
SV017-OHM-R2	2.1%	2.1%	3.2%	0.8%	0.1%
SV017-OHM-R3	4.7%	0.6%	1.6%	3.3%	0.3%
Train Blank	NA	NA	NA	NA	NA

Run Number	Filter	FH Rinse	KCl	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	KMnO <sub>4</sub>	Hydroxylamine Hydrochloride
Reagent Blank	NA	NA	NA	1.9%	2.7%	0.6%

### Mercury Triplicate Analysis RSD

(OHM QC limits:  $\leq 10\%$  for RSD)

Run Number	Filter	FH Rinse	KCl	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	KMnO <sub>4</sub>
SV014-OHM-R2	1.0%	5.7%	3.0%	6.3%	0.3%
SV015-OHM-R2	4.5%	3.0%	2.0%	3.2%	3.8%
SV016-OHM-R2	NA	NA	1.3%	2.8%	0.5%
SV017-OHM-R2	1.6%	2.3%	1.8%	3.2%	0.7%

## Summary of Quality Control Data

Mercury Spike Recoveries						
(QC limits: 85%-115% for Spike Recoveries)						
Run Number		Filter	FH Rinse	KCl	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	KMnO <sub>4</sub>
-----	----	-----	-----	-----	-----	-----
SV014-OHM-R3	# 1	92%	93%	92%	112%	104%
	# 2	90%	93%	93%	110%	104%
SV015-OHM-R3	# 1	90%	95%	93%	57%*	100%
	# 2	94%	95%	86%	56%*	99%
SV016-OHM-R3	# 1	76%*	88%	89%	63%*	90%
	# 2	77%*	89%	87%	64%*	90%
SV017-OHM-R3	# 1	89%	94%	92%	85%	112%
	# 2	90%	94%	94%	88%	112%

\*See Analytical Narrative, page 6.

# SAMPLE CUSTODY





Barr Engineering Co. Chain of Custody

**Request for Laboratory Analytical Services**

Sample Origination State:  
☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other:  
☒ MN ☐ WI

COC Number: **10420**

COC **2** of **3**

35042

Report Results To	Check One: <input checked="" type="checkbox"/> <b>Barr Engineering Company</b> 3128 14th Avenue East Hibbing, MN 55435-4803 (218) 262-8600 Project Contact: <u>MIKE NOASTREM</u> (Print Name) <u>MSN@BARR.COM</u> (email)		<input type="checkbox"/> <b>Barr Engineering Company</b> 5150 West 76th Street Edina, MN 55439-2330 (952) 832-2600		Send Invoice To	Project Number <u>23/69-2044.20-100 200</u> <b>Barr Engineering Company</b> Attn: Accounts Payable 4300 Marketpointe Drive Minneapolis, MN 55435-4803 Ph. (952) 832-2600 Fax (952) 832-2601			
	Special Instructions and/or specific regulatory requirements: (method, limit of detection, etc.) <u>ONTARIO HYDRO, Hg</u>		Requested Due Date: <input checked="" type="checkbox"/> Standard Turn Around Time <input type="checkbox"/> Rush (mm/dd/yyyy)			METHOD		SAMPLE FRACTION	
Sample Identification		Date/Time Collected	Media ID. #	Type Grab Comp. QC	ONTARIO HYDRO FILTER FRACTION 2 IN HD IMP 1-3 KCL IMP 4 50% H2O IMP 5-7 49% H2O		Total No. of Containers Remarks		
1. SV 017 TIR1		06/24/20	NA	X	X	1	1	1	5
2. ↓ TIR2		↓	↓	X	↓	1	1	1	5
3. ↓ TIR3		↓	↓	X	↓	1	1	1	5
4. TRAIN BLANK TIR00		06/24/20	↓	X	↓	1	1	1	3
5.									
6.									
7.									
8.									
9.									
10.									
Chain of Custody	Collected by (Print Name): <u>JOHN BOUVEY</u>		Relinquished by:		Received by:		Date/Time:		
	Collector's Signature: <u>[Signature]</u>		Date/Time: <u>06/24/20</u>		<u>[Signature]</u>		<u>06/24/20 11:15</u>		
Laboratory: <u>ELEMENT ONE</u>		Method of Shipment: <input type="checkbox"/> Sampler <input checked="" type="checkbox"/> FedEx <input type="checkbox"/> UPS Other:		<u>[Signature]</u>		<u>[Signature]</u>		<u>6/29/20 13:30</u>	
Sample Condition upon Receipt: <input type="checkbox"/> Acceptable <input type="checkbox"/> Other (explain)		Received at Lab by: <u>[Signature]</u>				<u>6-30-20 1515</u>			

Distribution: White-Original Accompanies Shipment to Lab; Yellow - Field Copy

Version 2 - Created 06/01/14

7-1-20 1230



BARR

☐ IA    ☐ ND    ☐ WI  
☐ MI    ☐ SD    Other: \_\_\_\_\_  
☒ MN    ☐ VT

COC 3 of 3

35042 Barr OHM Report Packet  
Page 13 of 34

# ANALYTICAL DATA



## Analytical Calculations

**Mercury Results (µg) =CVAF Results (µg)**

No calculation required.

### **Mercury-**

**Mercury Results (µg) = $\frac{\text{CVAA Results (µg)}}{\text{Aliquot (ml)}} \times \text{Final Volume (ml)}$**

### **Where-**

CVAA Results= Raw sample reading (µg)--*Hg-Data Sheet*

Aliquot= Sample Aliquot (Alq.)--*Hg-Data Sheet*

Final Volume (FV)--*Sample Submission*

## Analytical Calculations

### Spike Recovery-

$$\text{Spike (\%)} = \frac{(\text{Spiked Result } (\mu\text{g/L}) - \text{Sample Result } (\mu\text{g/L}))}{\text{Spike Amount } (\mu\text{g/L})} \times 100$$

### Where-

Spike Result = Raw sample concentration (ppb)--*Hg-Data Sheet*

Sample Result = Raw sample concentration (ppb)--*Hg-Data Sheet*

Spike Amount--*Hg- Data Sheet*

### Duplicate Analysis RPD-

$$\text{RPD (\%)} = \frac{(\text{Duplicate Result } (\mu\text{g/L}) - \text{Sample Result } (\mu\text{g/L}))}{\text{Average } (\mu\text{g/L})} \times 100$$

### Where-

Sample Result and Duplicate Results=Raw sample concentration (ppb)--*Hg-Data Sheet*

$$\text{Average} = \frac{(\text{Duplicate} + \text{Sample Results})}{2}$$

### Triplicate Analysis RSD-

$$\text{RSD (\%)} = \frac{\text{Standard Deviation } (\mu\text{g/L})}{\text{Average } (\mu\text{g/L})} \times 100$$

elementOne

## AIR TESTING SAMPLE SUBMISSION FORM

Lab ID 35042

Analysis Due Date 07.09.20

QA/QC/Report Due Date 07.13.20

Client:	Barr Engineering
Project No	23/69-2044.20 100 200

Date Rec	06.30 & 07.01.20
Time Rec	1515 & 1230

HNO <sub>3</sub> Lot:	59283 EMD	KBr Lot:	OHM-67-5	Volume Marked:	Y / N
HF Lot:	5116072 Fisher	KBrO <sub>3</sub> Lot:	OHM-67-4	Volume Loss Y:	N / ?
HCl Lot:	251602 JT Baker	Acetone Lot:			

Ref. Method:  
OHM

## Sample Identification

1	SV014-OHM-R1	7	SV016-OHM-R1	13	Train Blank
2	SV014-OHM-R2	8	SV016-OHM-R2	14	Reagent Blank (Page 2)
	SV014-OHM-R2 Triplicate		SV016-OHM-R2 Triplicate		
3	SV014-OHM-R3	9	SV016-OHM-R3		
	SV014-OHM-R3 Spike		SV016-OHM-R3 Spike		
4	SV015-OHM-R1	10	SV017-OHM-R1		
5	SV015-OHM-R2	11	SV017-OHM-R2		
	SV015-OHM-R2 Triplicate		SV017-OHM-R2 Triplicate		
6	SV015-OHM-R3	12	SV017-OHM-R3		
	SV015-OHM-R3 Spike		SV017-OHM-R3 Spike		

## Analyses Requested

Samples 1-13

Hg

Run / FB	Fil (C1) / Ace (C2a)		FH HNO <sub>3</sub> Rinse (C2)			KCl (C3)		H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub> (C4)		KMnO <sub>4</sub> (C5)	
	Fil ID	BV, ml	BV, ml	FV, ml	pH <2.0 Y/N	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml
1			130	200	Y	620	700	140	250	740	600
2.T			122			600		136		550	
3.S			114			615		144		560	
4			98			640		130		530	
5.T			76			630		130		510	
6.S			120			630		150		585	
7			134			605		134		580	
8.T			112			630		122		640	700
9.S			82			640		132		565	600
10			96			690		142		620	700
11.T			82			700	800	150		580	600
12.S			116			730		128		580	
13						425	500	110		560	

## Lab Communications

Rec Runs: C1, C2, C3, C4, C5; TB: C3, C4, C5; RB: C12, C7, C8, C9, C10, C11—07.01.20 LLB

Page 1 of 1

7/1/2020 2:25:22 PM

SS Form By: LLBLabeled By/Date: TAD 7.1.20C1 Prep By/Date: TAD 7/1/20C2 Prep By/Date: TAD 7/1/20C3 Prep By/Date: CM 01/06/20ID Verification By/Date: CM 7/1/20C4 Prep By/Date: CM 7/1/20C5 Prep By/Date: TAD 7/1/20C2a Prep By/Date: TAD 7/1/20

elementOne

35042 Barr OHM Report Packet

Page 17 of 34

# AIR TESTING SAMPLE SUBMISSION FORM

Lab ID 35042

--

Analysis	Due Date	07.09.20
QA/QC/Report	Due Date	07.13.20

Client:	Barr Engineering
Project No	23/69-2044.20 100 200

Date Rec	06.30 & 07.01.20
Time Rec	1515 & 1230

HNO <sub>3</sub> Lot: 59283 END	KBr Lot: OHM-67-5	Volume Marked <u>Y</u> N	Ref. Method: OHM
HF Lot: 5116022 fslg	KBrO <sub>3</sub> Lot: OHM-67-1	Volume Loss Y / <u>N</u> ?	
HCl Lot: 251602 JT Baker	Acetone Lot:		

### Sample Identification

14	Reagent Blank				

<b>Analyses Requested</b>	Sample 14	Hg
---------------------------	-----------	----

Lab ID	Cont.	Fraction	pH	BV, ml	Comments
14.1	C12	Filter Blank	NA	NA	
14.2	C7	0.1N HNO <sub>3</sub>	4.2	82	
14.3	C8	1.0 N KCl	4.2	130	
14.4	C9	5% HNO <sub>3</sub> / 10% H <sub>2</sub> O <sub>2</sub>	4.2	96	
14.5	C10	KMnO <sub>4</sub> /H <sub>2</sub> SO <sub>4</sub>	4.2	45	
14.6	C11	10% NH <sub>2</sub> OH.HCl or SO <sub>4</sub>	—	130	
		10% HNO <sub>3</sub>	—		

## Lab Communications

[illegible]

Page 2 of 2

7/1/2020 1:54:17 PM

SS Form By

Labeled By/Date TAD 7.1.20

C1 Prep By/Date\_\_\_\_\_

C2 Prep By/Date

C3 Prep By/Date

ID Verification By

C4 Prep By/Date C.A.M 7/10/20

C5 Prep By/Date TAD 7/14/20

C2a Prep By/Date

1/20





elementOne

## CVAF - MERCURY BATCH DIGESTION RUN

Date Prepared/Digested: 7/7/20

Prep By: CAM

SIF File #: 070720-1

Batch Analyst: TAD

Start Time: 1335

Typed By: TAD

Stop Time: 1945

Verified By: KUG

Using the Method Reagent Blank Solution and the 0.4µg/mL Working Hg Standards, make the following dilutions for the calibration and QC standards.

A/S	Curve & QC's	0.4ug/ml working std	40mL aliquot concentration	FV, ml	Standard Lot Numbers
7	Reagent Blank	0	0.0	400	
8	0.001 ug, DL	0.025mL	0.000025	400	Working Standard #1
9	0.002 ug	0.025mL	0.00005	200	Lot #: Hg4-15-6 by: TAD
10	0.004 ug	0.050mL	0.0001	200	Standard #2 (QC #2):
11	0.02 ug	0.250mL	0.0005	200	Lot #: Hg4-15-7
12	0.04 ug	0.500mL	0.001	200	Standard #3 (QC #3):
					Lot #: Hg4-15-8
13	QC #2= 0.02ug	0.250ml #2 std	0.0005	200	
14	QC #3= 0.02ug	0.250ml #3 std	0.0005	200	Curve prepared by: TAD

Initial Review By: TAD

Date: 7/8/20

Time:

Final QC Review By: KUG

Date: 7/8/20

Time: 1730

Comments: put wrong FV for 14  
35042-13.3

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
15	35042-1.3	10	700	2		OKM	
16	-2.3						
17	-2.3 D						
18	-2.3 TRP						
19	-3.3						
20	-3.3 +				0.07		
21	-4.3						
22	-5.3						
23	-5.3 D						
24	-5.3 TRP						
25	-6.3						

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion

"+" Denotes spike for Hg, Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample, unless otherwise noted.

**Digestion chemicals to be added in order at the following rate per 40ml volumes:**

Conc. HCl @ 1.2mL..... KBr @ 0.5mL..... KBrO<sub>3</sub> @ 0.5mL

HNO<sub>3</sub> Lot # 59283 EMP HCl Lot # 251602 JT Back Hydrox Lot #: Hg4-13-7

KBr# OHM-67-5 KBrO<sub>3</sub> Lot # OHM-67-4

Clear samples after digestion with 0.1 ml of Hydroxylamine solution per 40mL sample.

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
26	35042-6.3 +	10	700	2	0.02	OHM	
27	-7.3	↓	↓	↓		↓	
28	-8.3	↓	↓	↓		↓	
29	-8.3 D	↓	↓	↓		↓	
30	-8.3 TAP	↓	↓	↓		↓	
31	-9.3	↓	↓	↓		↓	
32	-9.3 +	↓	↓	↓	0.02	↓	
33	-10.3	↓	↓	↓		↓	
34	-11.3	↓	800	↓		↓	
35	-11.3 D	↓	↓	↓		↓	
36	-11.3 TAP	↓	↓	↓		↓	
37	-12.3	↓	↓	↓		↓	
38	-12.3 +	↓	↓	↓	0.02	↓	
39	-13.3	20	500	↓		↓	
40	-14.3	↓	100 7.3 20 10 130	↓		↓	
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

elementOne

## CVAF - MERCURY BATCH DIGESTION RUN

Date Prepared/Digested: 7/8/20 Prep By: TAD SIF File #: 070820-2  
 Batch Analyst: TAD Start Time: 1650 Typed By: TAD  
 Stop Time: 1822 Verified By: KLG

Using the Method Reagent Blank Solution and the 0.4µg/mL Working Hg Standards, make the following dilutions for the calibration and QC standards.

A/S	Curve & QC's	0.4ug/ml working std	40mL aliquot concentration	FV, ml	Standard Lot Numbers
7	Reagent Blank	0	0.0	400	
8	0.001 ug, DL	0.025mL	0.000025	400	Working Standard #1
9	0.002 ug	0.025mL	0.00005	200	Lot #: <u>H4-15-6</u> by: <u>TAD</u>
10	0.004 ug	0.050mL	0.0001	200	Standard #2 (QC #2):
11	0.02 ug	0.250mL	0.0005	200	Lot #: <u>H4-15-7</u>
12	0.04 ug	0.500mL	0.001	200	Standard #3 (QC #3):
					Lot #: <u>H4-15-8</u>
13	QC #2= 0.02ug	0.250ml #2 std	0.0005	200	
14	QC #3= 0.02ug	0.250ml #3 std	0.0005	200	Curve prepared by: <u>TAD</u>

Initial Review By: TADDate: 7/9/20

Time:

Final QC Review By: KLGDate: 7/9/20Time: 1400

Comments:

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
15	<u>35042-1.2</u>	<u>20</u>	<u>200</u>	<u>2</u>		<u>OHM</u>	
16	<u>-2.2</u>						
17	<u>-2.2 TRP</u>						
18	<u>-3.3</u>						
19	<u>-3.3 +</u>				<u>0.02</u>		
20	<u>-4.3</u>						
21	<u>-5.3</u>						
22	<u>-5.3 TRP</u>						
23	<u>-6.3</u>						
24	<u>-6.3 +</u>				<u>0.02</u>		
25	<u>-7.3</u>						

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion

"+" Denotes spike for Hg. Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample, unless otherwise noted.

**Digestion chemicals to be added in order at the following rate per 40ml volumes:**

Conc. HCl @ 1.2mL..... KBr @ 0.5mL..... KBrO<sub>3</sub> @ 0.5mL

HNO<sub>3</sub> Lot # 59283 EMD HCl Lot # 4118110 Fisher Hydrox Lot #: H4-13-7

KBr# OHM-67-5 KBrO<sub>3</sub> Lot # OHM-67-4

Clear samples after digestion with 0.1 ml of Hydroxylamine solution per 40mL sample.

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
26	35042-8.2	20	200	2		OHM	
27	-8.2D	↓	↓	↓		↓	
28	-9.2	↓	↓	↓		↓	
29	-9.2+	↓	↓	↓	0.02	↓	
30	-10.2	↓	↓	↓		↓	
31	-11.2	↓	↓	↓		↓	
32	-11.2D	↓	↓	↓		↓	
33	-12.2	↓	↓	↓		↓	
34	-12.2+	↓	82↓	↓	0.02	↓	
35	-14.2	↓	82↓	↓		↓	
36							
37				↓			
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

elementOne

## CVAF - MERCURY BATCH DIGESTION RUN

Date Prepared/Digested: 7/9/20Prep By: TADSIF File #: 070920-1Batch Analyst: TADStart Time: 1300Typed By: TADStop Time: 1739Verified By: DKH

Using the Method Reagent Blank Solution and the 0.4µg/mL Working Hg Standards, make the following dilutions for the calibration and QC standards.

A/S	Curve & QC's	0.4µg/ml working std	40mL aliquot concentration	FV, ml	Standard Lot Numbers
7	Reagent Blank	0	0.0	400	
8	0.001 ug, DL	0.025mL	0.000025	400	Working Standard #1
9	0.002 ug	0.025mL	0.00005	200	Lot #: H <sub>5</sub> Y-15-6 by: TAD
10	0.004 ug	0.050mL	0.0001	200	Standard #2 (QC #2):
11	0.02 ug	0.250mL	0.0005	200	Lot #: H <sub>5</sub> Y-15-7
12	0.04 ug	0.500mL	0.001	200	Standard #3 (QC #3):
					Lot #: H <sub>5</sub> Y-15-8
13	QC #2= 0.02ug	0.250ml #2 std	0.0005	200	
14	QC #3= 0.02ug	0.250ml #3 std	0.0005	200	Curve prepared by: TAD

Initial Review By: TADDate: 7/10/20Time: 945Final QC Review By: DKHDate: 7/10/20Time: 1230Comments: 35042-5.4 trp, 9.4 sp, 14.4

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
15	35040-13.3	20	500	2		OHM	
16	-1.4		250				
17	-2.4						
18	-2.4 trp						
19	-3.4						
20	-3.4 +				0.02		
21	-4.4						
22	-5.4						
23	-5.4 trp						
24	-6.4						
25	-6.4 +				0.02		

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion

"+" Denotes spike for Hg. Use calibration working 0.4µg/ml standard at the rate of 0.050ml per 40ml sample, unless otherwise noted.

**Digestion chemicals to be added in order at the following rate per 40ml volumes:**Conc. HCl @ 1.2mL..... KBr @ 0.5mL..... KBrO<sub>3</sub> @ 0.5mLHNO<sub>3</sub> Lot # 59283 FMO HCl Lot # 4118110 fslr Hydrox Lot # H<sub>5</sub>Y-13-7KBr# OHM-67-5 KBrO<sub>3</sub> Lot # OHM-67-4

Clear samples after digestion with 0.1 ml of Hydroxylamine solution per 40mL sample.

SIF File #: 070920-1

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
26	35042-7.4	20	250	2		OHM	
27	-8.4						
28	-8.4 + TP						
29	-9.4						
30	-9.4 +				0.02		
31	-10.4						
32	-11.4						
33	-11.4 + TP						
34	-12.4						
35	-12.4 +				0.02		
36	-13.4						
37	-14.4		96				
38	-3.4 x 2	10	250	2		OHM	
39	-3.4 + x 2						
40	-1.4 x 2						
41	-2.4 x 2						
42	-2.4 + TP x 2						
43	-4.4 x 2						
44	-5.4 x 2						
45	-5.4 + TP x 2						
46	-6.4 x 2						
47	-6.4 x 2 +						
48	-7.4 x 2						
49	-8.4 x 2						
50	-8.4 + TP x 2						
51	-9.4 x 2						
52	-9.4 x 2 +						
53	-10.4 x 2						
54	-11.4 x 2						
55	-11.4 + TP x 2						
56	-12.4 x 2						
57	-12.4 x 2 +						
58	-13.4 x 2						
59	-14.4 x 2		96				
60							

elementOne

## CVAF - MERCURY BATCH DIGESTION RUN

Date Prepared/Digested: 7/14/20Prep By: TADSIF File #: 071420-1MBatch Analyst: TADStart Time: 1530Typed By: TAD

Stop Time:

Verified By:

Using the Method Reagent Blank Solution and the 0.4µg/mL Working Hg Standards, make the following dilutions for the calibration and QC standards.

A/S	Curve & QC's	0.4ug/ml working std	40mL aliquot concentration	FV, ml	Standard Lot Numbers
7	Reagent Blank	0	0.0	400	
8	0.001 ug, DL	0.025mL	0.000025	400	Working Standard #1
9	0.002 ug	0.025mL	0.00005	200	Lot #: <u>H54-17-1</u> by: <u>TAD</u>
10	0.004 ug	0.050mL	0.0001	200	Standard #2 (QC #2):
11	0.02 ug	0.250mL	0.0005	200	Lot #: <u>H54-17-2</u>
12	0.04 ug	0.500mL	0.001	200	Standard #3 (QC #3):
					Lot #: <u>H54-17-3</u>
13	QC #2= 0.02ug	0.250ml #2 std	0.0005	200	
14	QC #3= 0.02ug	0.250ml #3 std	0.0005	200	Curve prepared by: <u>TAD</u>

Initial Review By: TADDate: 7/15/20Time: 8:15Final QC Review By: RUNDate: 7/15/20Time: 830Comments: All O.S's

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
15	<u>35042-3.4</u>	<u>20</u>	<u>250</u>	<u>2</u>		<u>OHM</u>	
16	<u>-5.4 + sp</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
17	<u>-9.4</u>	<u>10</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
18	<u>-9.4 +</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>0.02</u>	<u>↓</u>	
19	<u>-14.4</u>	<u>20</u>	<u>96</u>	<u>↓</u>		<u>↓</u>	
20	<u>-1.5</u>	<u>↓</u>	<u>600</u>	<u>↓</u>		<u>↓</u>	
21	<u>-2.5</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
22	<u>-2.5 + sp</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
23	<u>-3.5</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
24	<u>-3.5 +</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>0.02</u>	<u>↓</u>	
25	<u>-4.5</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion

"+" Denotes spike for Hg. Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample, unless otherwise noted.

**Digestion chemicals to be added in order at the following rate per 40ml volumes:**Conc. HCl @ 1.2mL..... KBr @ 0.5mL..... KBrO<sub>3</sub> @ 0.5mLHNO<sub>3</sub> Lot # 59283 EMD HCl Lot # 4118110 Fisher Hydrox Lot # H54-12-3KBr# OHM-67-5 KBrO<sub>3</sub> Lot # OHM-67-4

Clear samples after digestion with 0.1 ml of Hydroxylamine solution per 40mL sample.



A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
26	35042-S.5	20	600	2		OHM	
27	-5.5 +P	↓	600	↓		↓	
28	-6.5	↓	↓	↓	0.02	↓	
29	-6.5 +	↓	↓	↓		↓	
30	-7.5	↓	↓	↓		↓	
31	-8.5	↓	700	↓		↓	
32	-8.5 +P	↓	↓	↓		↓	
33	-9.5	↓	600	↓		↓	
34	-9.5 +	↓	↓	↓	0.02	↓	
35	-10.5	↓	700	↓		↓	
36	-11.5	↓	600	↓		↓	
37	-11.5 +P	↓	↓	↓		↓	
38	-12.5	↓	↓	↓		↓	
39	-12.5 +	↓	↓	↓	0.02	↓	
40	-13.5	↓	↓	↓		↓	
41	-14.5	↓	45	↓		↓	
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

## CVAF - MERCURY BATCH DIGESTION RUN

Date Prepared/Digested: 7/15/20 Prep By: TAD SIF File #: 071520-1m  
 Batch Analyst: TAD Start Time: 1521 Typed By: TAD  
 Stop Time: 1810 Verified By: YUH

Using the Method Reagent Blank Solution and the 0.4µg/mL Working Hg Standards, make the following dilutions for the calibration and QC standards.

A/S	Curve & QC's	0.4ug/ml working std	40mL aliquot concentration	FV, ml	Standard Lot Numbers
7	Reagent Blank	0	0.0	400	
8	0.001 ug, DL	0.025mL	0.000025	400	Working Standard #1
9	0.002 ug	0.025mL	0.00005	200	Lot #: <u>Hg4-17-1</u> by: <u>TAD</u>
10	0.004 ug	0.050mL	0.0001	200	Standard #2 (QC #2):
11	0.02 ug	0.250mL	0.0005	200	Lot #: <u>Hg4-17-2</u>
12	0.04 ug	0.500mL	0.001	200	Standard #3 (QC #3):
					Lot #: <u>Hg4-17-3</u>
13	QC #2= 0.02ug	0.250ml #2 std	0.0005	200	
14	QC #3= 0.02ug	0.250ml #3 std	0.0005	200	Curve prepared by: <u>TAD</u>

Initial Review By: TADDate: 7/16/20Time: 0836Final QC Review By: YUHDate: 7/16/20Time: 0900

Comments:

1200

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
15	<u>35042-13.5</u>	<u>20</u>	<u>600</u>	<u>2</u>		<u>OHM</u>	
16	<u>-14.5</u>	<u>↓</u>	<u>45</u>	<u>↓</u>		<u>↓</u>	
17	<u>-URBFI</u>	<u>10</u>	<u>50</u>	<u>↓</u>		<u>↓</u>	
18	<u>-URBFI +</u>	<u>5</u>	<u>↓</u>	<u>↓</u>	<u>0.01</u>	<u>↓</u>	
19	<u>-1.1</u>	<u>10</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
20	<u>-2.1</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
21	<u>-2.1 +rp</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
22	<u>-3.1</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
23	<u>-3.1 +</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>0.02</u>	<u>↓</u>	
24	<u>-4.1</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	
25	<u>-5.1</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	

NOTES: Lab blanks and spikes must be prepared with each batch digestion

"+" Denotes spike for Hg. Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample, unless otherwise noted.

Digestion chemicals to be added in order at the following rate per 40ml volumes:

Conc. HCl @ 1.2mL..... KBr @ 0.5mL..... KBrO<sub>3</sub> @ 0.5mLHNO<sub>3</sub> Lot # 59283 EMD HCl Lot #: 4118110 Fisher/Hydrox Lot#: Hg4-13-7KBr# OHM-67-5 KBrO<sub>3</sub> Lot # OHM-67-4

Clear samples after digestion with 0.1 ml of Hydroxylamine solution per 40mL sample.

A/S	LAB #	Aliquot, mL	Sample FV, mL	Times to Run	Spike, µg	Method	Comments
24	35042-5.8 + TP	10	50	2		OHM	
25	-6.1	↓	↓	↓		↓	
26	-6.1 +	↓	↓	↓	0.02	↓	
27	-7.1	↓	↓	↓		↓	
28	-8.1	↓	↓	↓		↓	
28	-8.1 + TP	↓	↓	↓		↓	
29	-9.1	↓	↓	↓		↓	
30	-9.1 +	↓	↓	↓	0.02	↓	
31	-10.1	↓	↓	↓		↓	
32	-11.1	↓	↓	↓		↓	
32	-11.1 + TP	↓	↓	↓		↓	
33	-12.1	↓	↓	↓		↓	
34	-12.1 +	↓	↓	↓	0.02	↓	
35	-14.1	↓	↓	↓		↓	
36	-14.6	20	130	2		↓	
37	35042-8.1, P1 + TP	10	50	2		OHM	
38	-6.1	5	↓	↓		↓	
39	-6.1 +	↓	↓	↓	0.02	↓	
40	-7.1	↓	↓	↓		↓	
41	-8.1	↓	↓	↓		↓	
42	-9.1 +	↓	↓	↓	0.02	↓	
43	-4.6	20	130	2		↓	
44	-6.1 x 2	25	50	2		OHM	
45	-6.1 x 2 +	↓	↓	↓	0.01	↓	
46	-9.1 x 2	↓	↓	↓		↓	
47	-9.1 x 2 +	↓	↓	↓	0.01	↓	
48							
49							
50							
51							
52							
53							
54							
55							
56							

# MERCURY BATCH DIGESTION - RUN WORKSHEET

Date Prepared/Digested: 07-15-20 Prep By: CAM SIF File #: 071620-1  
 Block #1 Temperature: ~95 Start Time: 5:45 Machine ID: FIMS 2  
 Block #2 Temperature: 88.2 Stop Time: 8:00 Batch Analyst: CAM/TAD  
 Block #3 Temperature: 92.7 Typed By: CAM Verified By: TAD

A/S	Curve & QC's	0.4ug/ml working std		BV, ml	FV, ml	Standard Lot Numbers
1	Lab BLK (3/ batch)	0		40	40	Standard #1 (for working std) Lot #: 4807882
2	0.004 ug	0.01ml		40	40	Working Standard
3	0.04 ug	0.10ml		40	40	Lot #: Hg4-17-1 by: T
4	0.08 ug	0.20ml		40	40	Standard #2 (QC #2):
5	0.16 ug	0.40ml		40	40	Lot #: Hg4-17-2
6	0.20ug	0.50ml		40	40	Standard #3 (QC #3): Lot #: Hg4-17-3
7	QC #2= 0.08ug	0.2ml #2 std		40	40	
8	QC #3= 0.08ug	0.2ml #3 std		40	40	Curve prepared by: CAM

Initial Review By: CAM/TAD Date: 7/14/20 Time: 1:25  
 Final QC Review By: KH Date: 7/16/20 Time: 1450  
 Comments: sent to 35079

A/S	LAB #	Method	Wt (g)/ FV (mL)	Prep Aliquot Used, mL	Aliquot or Calc Mass	FV, mL or "1" for conc.	Comments
9	34785-2400	7470A			6.2	5	TV=3.91
10	V/L				1	1	
11	TCIP B124				20	1	
12	TCIP B124+						
13	-124						
14	TCIP F126K122						
15	-B1K122-123						
16	38122-1						
17	-2						
18	-3						
19	-3+						

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion

"+" Denotes spike for Hg. Use calibration working 0.4ug/ml standard at the rate of 0.20ml per 40ml sample, unless otherwise noted.

**Digestion chemicals to be added in order at the following rate per 40ml volumes.**

H<sub>2</sub>SO<sub>4</sub> @ 2.0ml..... HNO<sub>3</sub> @ 1.0ml..... KMnO<sub>4</sub> @ 6.0ml..... Persulfate @ 3.2ml

H<sub>2</sub>SO<sub>4</sub> Lot # 191965 Fisher HNO<sub>3</sub> Lot # 59285 EMD HCl Lot # 4118110 Fisher

Persulfate Lot # Hg4-13-3 KMnO<sub>4</sub> Lot # Hg4-13-10 Hydrox Lot # Hg4-13-8

Clear samples after digestion with 2.4 ml of Hydroxylamine solution.

SIF File #: 071420-1

A/S	LAB #	Method	Wt (g)/ FV (mL)	Prep Aliquot Used, mL	Aliquot or Calc Mass	FV, mL or "1" for conc.	Comments
✓ 20	35123	7470A			20	1	
21	35123D	<del>CA</del> ↓			↓	↓	
22	35079-1C	M29			4	400	
23	35079-2C						
24	-2CD						
25	-3C						
26	-3C+						
27	-4C						
28	-5C						
29	-6C						
30	-6CD						
31	-7C						
32	-7C+						
33	-8C						
34	-9C						
35	-10C						
36	-11C						
37	-1FH				0.1	100	
38	-2FH						
39	-2FHD						
40	-3FH						
41	-3FH+						
42	-4FH						
43	-2BH				1	700	
44	-2BHD				↓	↓	
✓ 45	35112-LRB				4	100	
46	-LRB+				1.6	↓	
✓ 47	35042-1.5	OHM			4	600	
48	-2.5						
49	-2.5T						
50	-3.5						
51	-3.5+						
52	-4.5						
53	-5.5						
54	-5.5F	↓			↓	↓	

SIF File #: 071620-1

A/S	LAB #	Method	Wt (g)/ FV (mL)	Prep Aliquot Used, mL	Aliquot or Calc Mass	FV, mL or "1" for conc.	Comments
✓ 55	5042-6.5	OHM			4	600	
56	-6.5 +	↓			↓	600	
57	-7.5	↓			↓	600	
58	-8.5	↓			↓	700	
59	-8.5 T	↓			↓	700	
60	-9.5	↓			↓	600	
61	-9.5 +	↓			↓	600	
62	-10.5	↓			↓	700	
63	-11.5	↓			↓	600	
64	-11.5 T	↓			↓		
65	-12.5	↓			↓		
✓ 66	-12.5 +	↓			↓		
✓ 67	5110-1BH	M29			4	335	
68	-1BH D	↓			↓		
69	-1BH +	↓			↓		
70	-1A	↓			4	200	
71	-1A D	↓			↓		
72	-1A +	↓			↓		
✓ 73	TOT LRB	↓			4	1	
✓ 74	TOT LRB +	↓			4		was double spiked 0.18g
✓ 75	35088 TOT	↓	0.5240/50	4	0.0419		
✓ 76	35095-1 TOT	↓	0.5304/50	↓	0.0424		
✓ 77	35124 TOT	↓	0.5325/50	↓	0.0426		
✓ 78	35076-LRB	7470A			5	1	
79	-LRB +	↓			↓		
80	-1	↓			↓		
81	-2	↓			↓		
82	-3	↓			↓		
83	-3 +	↓			↓		
84	-4	↓			↓		
85							
86							
87							
88							
89							

PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
0		0	2.791851	-43.628174	-1.357342	0	0	----	----	7/7/2020 15:06
0.001		0.001	26.432774	1252.566406	0.06966	23640.92188	2.791851	----	----	7/7/2020 15:08
0.002		0.002	49.525833	2290.289795	-0.148989	23366.98828	2.883164	----	----	7/7/2020 15:10
0.004		0.004	92.307991	4301.97998	-0.486688	22327.32813	3.691785	----	----	7/7/2020 15:12
0.02		0.02	425.999512	21019.75	-1.164416	21041.40234	5.788036	----	----	7/7/2020 15:14
0.04		0.04	892.438293	42112.68359	-1.41616	22060.65039	1.905459	----	----	7/7/2020 15:17
DL		0.0011	26.008589	1040.661255	-1.563795	22060.65039	1.905459	1	1	7/7/2020 15:20
QC 2		0.0206	456.797516	21806.39648	0.018009	22060.65039	1.905459	1	1	7/7/2020 15:22
QC 3		0.0198	437.60672	21115.66406	-1.511974	22060.65039	1.905459	1	1	7/7/2020 15:24
BLK		0	2.574023	-189.386459	-1.963649	22060.65039	1.905459	1	1	7/7/2020 15:27
35042-6.3	#1	0.9698	307.554108	14960.04199	-0.038159	22060.65039	1.905459	10	700	7/7/2020 15:29
35042-6.3	#2	0.9286	294.569916	14664.5	-1.350595	22060.65039	1.905459	10	700	7/7/2020 15:31
35042-6.3 SPK	#1	2.2495	710.84967	34072.35938	-1.267343	22060.65039	1.905459	10	700	7/7/2020 15:34
35042-6.3 SPK	#2	2.1532	680.47644	34093.95313	-1.864506	22060.65039	1.905459	10	700	7/7/2020 15:36
35042-7.3	#1	0.4634	147.935104	7093.660645	-2.047556	22060.65039	1.905459	10	700	7/7/2020 15:39
35042-7.3	#2	0.4721	150.700623	7090.065918	-2.23666	22060.65039	1.905459	10	700	7/7/2020 15:41
35042-8.3	#1	0.4731	150.999359	7244.846191	-1.83514	22060.65039	1.905459	10	700	7/7/2020 15:43
35042-8.3	#2	0.4611	147.223846	7221.748047	-2.440469	22060.65039	1.905459	10	700	7/7/2020 15:45
35042-8.3 TRP	#1	0.4693	149.802109	7165.187012	-2.02052	22060.65039	1.905459	10	700	7/7/2020 15:48
35042-8.3 TRP	#2	0.4494	143.539642	7114.080566	-1.915295	22060.65039	1.905459	10	700	7/7/2020 15:50
35042-9.3	#1	1.1978	379.379456	18475.44141	-1.781862	22060.65039	1.905459	10	700	7/7/2020 15:52
35042-9.3	#2	1.1812	374.158752	18166.96484	-1.601485	22060.65039	1.905459	10	700	7/7/2020 15:54
35042-9.3 SPK	#1	2.4388	770.494202	37087.42578	-1.590503	22060.65039	1.905459	10	700	7/7/2020 15:57
35042-9.3 SPK	#2	2.4037	759.433838	37551.9375	-2.511327	22060.65039	1.905459	10	700	7/7/2020 15:59
35042-10.3	#1	1.4643	463.370697	23237.25586	-2.535285	22060.65039	1.905459	10	700	7/7/2020 16:02
35042-10.3	#2	1.5366	486.16153	23151.45117	-2.029977	22060.65039	1.905459	10	700	7/7/2020 16:04
DL		0.0011	25.504057	850.427673	-1.963254	22060.65039	1.905459	1	1	7/7/2020 16:07
QC 2		0.0203	448.67334	21736.21484	-0.746218	22060.65039	1.905459	1	1	7/7/2020 16:09
BLK		0.0002	6.980607	171.522324	-1.281922	22060.65039	1.905459	1	1	7/7/2020 16:11
35042-11.3	#1	1.3532	375.071808	17990.40039	0.071818	22060.65039	1.905459	10	800	7/7/2020 16:14
35042-11.3	#2	1.3106	363.32019	17950.01953	-1.002991	22060.65039	1.905459	10	800	7/7/2020 16:16
35042-11.3 TRP	#1	1.3115	363.559814	17414.89453	-1.79074	22060.65039	1.905459	10	800	7/7/2020 16:19
35042-11.3 TRP	#2	1.2803	354.964203	17433.13867	-1.253472	22060.65039	1.905459	10	800	7/7/2020 16:21
35042-12.3	#1	1.6777	464.542084	23262.76367	-1.173941	22060.65039	1.905459	10	800	7/7/2020 16:23
35042-12.3	#2	1.7044	471.917694	23184.23633	-2.232534	22060.65039	1.905459	10	800	7/7/2020 16:26
35042-12.3 SPK	#1	3.1656	874.832947	42907.46484	-1.925263	22060.65039	1.905459	10	800	7/7/2020 16:28
35042-12.3 SPK	#2	3.1922	882.177979	43018.24219	-2.244611	22060.65039	1.905459	10	800	7/7/2020 16:31
35042-14.3	#1	0.0011	6.788603	334.747986	-0.604903	22060.65039	1.905459	20	130	7/7/2020 16:38
35042-14.3	#2	0.001	6.380444	332.447388	-0.222874	22060.65039	1.905459	20	130	7/7/2020 16:40
DL		0.0011	25.173025	1233.470947	-0.286794	22060.65039	1.905459	1	1	7/7/2020 16:42
QC 2		0.0204	452.51712	22039.66016	-0.251545	22060.65039	1.905459	1	1	7/7/2020 16:44
BLK		0.0001	4.372944	83.347855	-1.17802	22060.65039	1.905459	1	1	7/7/2020 16:47
35042-1.3	#1	0.7482	237.71225	11999.12012	-0.103604	22060.65039	1.905459	10	700	7/7/2020 16:49
35042-1.3	#2	0.7467	237.241745	11863.78809	-1.247293	22060.65039	1.905459	10	700	7/7/2020 16:52
35042-2.3	#1	0.8252	261.967133	12214.54004	-0.873552	22060.65039	1.905459	10	700	7/7/2020 16:54
35042-2.3	#2	0.7846	249.182816	12321.33984	0.020577	22060.65039	1.905459	10	700	7/7/2020 16:56
35042-2.3 TRP	#1	0.7822	248.402374	12168.37109	-0.656805	22060.65039	1.905459	10	700	7/7/2020 16:59
35042-2.3 TRP	#2	0.7635	242.534088	12015.76563	-2.637539	22060.65039	1.905459	10	700	7/7/2020 17:01
35042-3.3	#1	0.9949	315.46286	15799.69238	-1.349378	22060.65039	1.905459	10	700	7/7/2020 17:03
35042-3.3	#2	1.0236	324.486847	15999.78027	-1.439174	22060.65039	1.905459	10	700	7/7/2020 17:06
35042-3.3 SPK	#1	2.2995	726.583069	35642.38672	-1.248781	22060.65039	1.905459	10	700	7/7/2020 17:08

elementOne

PS Analytical Millennium Galahad CVAF Analyzer

35042-3.3 SPK	#2	2.3144	731.288452	36065.44141	-2.347801	22060.65039	1.905459	10	700	7/7/2020 17:11
35042-4.3	#1	1.1556	366.109741	17797.59766	-2.036389	22060.65039	1.905459	10	700	7/7/2020 17:13
35042-4.3	#2	1.1436	362.327545	17843.95117	-1.528888	22060.65039	1.905459	10	700	7/7/2020 17:15
35042-5.3	#1	1.0443	331.027039	15555.72266	-1.657705	22060.65039	1.905459	10	700	7/7/2020 17:18
35042-5.3	#2	1.0095	320.065704	15482.84375	-1.179923	22060.65039	1.905459	10	700	7/7/2020 17:20
35042-5.3 TRP	#1	1.0094	320.023071	15395.72461	-1.410216	22060.65039	1.905459	10	700	7/7/2020 17:23
35042-5.3 TRP	#2	1.0034	318.11972	15327.31934	-1.293016	22060.65039	1.905459	10	700	7/7/2020 17:25
DL		0.001	24.074955	866.56073	-1.492405	22060.65039	1.905459	1	1	7/7/2020 17:27
QC 2		0.0206	456.911255	22411.91016	-0.480759	22060.65039	1.905459	1	1	7/7/2020 17:29
BLK		0.0002	6.866243	193.615662	-0.92312	22060.65039	1.905459	1	1	7/7/2020 17:32
0		0	1.986417	85.808495	-0.015173	0	0 ----	----		7/8/2020 15:57
0.001		0.001	25.19787	1215.783691	-0.047137	23211.45117	1.986418	----	----	7/8/2020 16:00
0.002		0.002	49.112186	2280.485596	0.07623	23562.87891	1.869279	----	----	7/8/2020 16:02
0.004		0.004	96.426781	4461.913574	-0.411515	23641.55859	1.808088	----	----	7/8/2020 16:04
0.02		0.02	472.340576	22045.39648	-1.049074	23519.60938	2.00689	----	----	7/8/2020 16:06
0.04		0.04	959.105469	44783.45313	-1.664855	23889.17383	0.599101	----	----	7/8/2020 16:09
BLK		0.0002	4.750126	7.479285	-1.295856	23889.17383	0.599101	1	1	7/8/2020 16:11
DL		0.0012	30.233591	1400.499268	-0.429736	23889.17383	0.599101	1	1	7/8/2020 16:14
QC 2		0.0208	497.64447	23277.55859	-0.339168	23889.17383	0.599101	1	1	7/8/2020 16:16
QC 3		0.0201	481.90564	22594.23828	-1.213815	23889.17383	0.599101	1	1	7/8/2020 16:18
BLK		0.0001	2.679198	16.064617	-0.370963	23889.17383	0.599101	1	1	7/8/2020 16:24
35042-2.2	#1	0.014	33.999577	1674.27356	0.03729	23889.17383	0.599101	20	200	7/8/2020 16:28
35042-2.2	#2	0.0133	32.454277	1541.539429	-0.423386	23889.17383	0.599101	20	200	7/8/2020 16:30
35042-2.2 TRP	#1	0.0125	30.487055	1447.233521	-0.351022	23889.17383	0.599101	20	200	7/8/2020 16:32
35042-2.2 TRP	#2	0.0124	30.266533	1446.577148	-0.319312	23889.17383	0.599101	20	200	7/8/2020 16:34
35042-1.2	#1	0.0107	26.180878	1247.634888	-0.330886	23889.17383	0.599101	20	200	7/8/2020 16:37
35042-1.2	#2	0.0105	25.702147	1219.986572	-0.388944	23889.17383	0.599101	20	200	7/8/2020 16:39
35042-3.2	#1	0.0162	39.384827	1870.3302	-0.48684	23889.17383	0.599101	20	200	7/8/2020 16:41
35042-3.2	#2	0.016	38.937138	1854.252808	-0.837322	23889.17383	0.599101	20	200	7/8/2020 16:43
35042-3.2 SPK	#1	0.2013	481.469391	23493.05273	-0.516158	23889.17383	0.599101	20	200	7/8/2020 16:45
35042-3.2 SPK	#2	0.2024	484.183289	23572.47852	-1.045825	23889.17383	0.599101	20	200	7/8/2020 16:48
35042-4.2	#1	0.0235	56.792248	2569.221436	-1.436015	23889.17383	0.599101	20	200	7/8/2020 16:51
35042-4.2	#2	0.0241	58.106369	2767.544922	-0.659484	23889.17383	0.599101	20	200	7/8/2020 16:53
35042-5.2	#1	0.0201	48.5755	2294.48584	-0.927232	23889.17383	0.599101	20	200	7/8/2020 16:55
35042-5.2	#2	0.0199	48.131084	2277.801758	-0.697407	23889.17383	0.599101	20	200	7/8/2020 16:57
35042-5.2 TRP	#1	0.019	45.967422	2143.287598	-0.612227	23889.17383	0.599101	20	200	7/8/2020 16:59
35042-5.2 TRP	#2	0.0193	46.650024	2183.250732	-0.588004	23889.17383	0.599101	20	200	7/8/2020 17:01
DL		0.0012	28.541153	1276.448364	-0.474982	23889.17383	0.599101	1	1	7/8/2020 17:04
QC 2		0.021	502.081268	23438.40625	-0.084738	23889.17383	0.599101	1	1	7/8/2020 17:06
BLK		0.0001	2.808468	-18.130384	-1.014546	23889.17383	0.599101	1	1	7/8/2020 17:08
35042-6.2	#1	0.0317	76.221008	3698.932373	-0.179338	23889.17383	0.599101	20	200	7/8/2020 17:11
35042-6.2	#2	0.0303	72.918777	3436.477783	-0.735402	23889.17383	0.599101	20	200	7/8/2020 17:13
35042-6.2 SPK	#1	0.2214	529.474548	25332.48047	-0.698289	23889.17383	0.599101	20	200	7/8/2020 17:15
35042-6.2 SPK	#2	0.2219	530.647705	25286.21484	-1.224843	23889.17383	0.599101	20	200	7/8/2020 17:18
35042-7.2	#1	0.0073	18.013721	633.999756	-2.004169	23889.17383	0.599101	20	200	7/8/2020 17:20
35042-7.2	#2	0.0081	20.044498	941.453918	-0.599644	23889.17383	0.599101	20	200	7/8/2020 17:22
35042-8.2	#1	0.0065	16.066002	759.664246	-0.384009	23889.17383	0.599101	20	200	7/8/2020 17:25
35042-8.2	#2	0.0063	15.727202	750.943909	-0.166915	23889.17383	0.599101	20	200	7/8/2020 17:27
35042-8.2 TRP	#1	0.0058	14.572244	680.110779	-0.344125	23889.17383	0.599101	20	200	7/8/2020 17:29
35042-8.2 TRP	#2	0.0058	14.455462	688.46521	-0.307842	23889.17383	0.599101	20	200	7/8/2020 17:31
35042-9.2	#1	0.0176	42.688961	2061.35498	-0.090345	23889.17383	0.599101	20	200	7/8/2020 17:33
35042-9.2	#2	0.0174	42.150574	1988.734131	-0.407488	23889.17383	0.599101	20	200	7/8/2020 17:35



PS Analytical Millennium Galahad CVAF Analyzer

35042-9.2 SPK #1	0.1942	464.567841	22350.91992	-0.761619	23889.17383	0.599101	20	200	7/8/2020 17:38
35042-9.2 SPK #2	0.1954	467.403229	22334.28125	-1.139218	23889.17383	0.599101	20	200	7/8/2020 17:40
35042-10.2 #1	0.0183	44.302422	1911.518921	-1.897917	23889.17383	0.599101	20	200	7/8/2020 17:43
35042-10.2 #2	0.0186	44.976585	2102.37207	-0.458192	23889.17383	0.599101	20	200	7/8/2020 17:45
DL	0.0012	29.422546	1312.477539	-0.540206	23889.17383	0.599101	1	1	7/8/2020 17:47
QC 2	0.0209	500.183014	23430.64844	-0.234753	23889.17383	0.599101	1	1	7/8/2020 17:49
BLK	0.0001	3.405774	29.189938	-1.097714	23889.17383	0.599101	1	1	7/8/2020 17:52
35042-11.2 #1	0.0242	58.329479	2785.158936	-0.007593	23889.17383	0.599101	20	200	7/8/2020 17:54
35042-11.2 #2	0.0237	57.28804	2663.274414	-0.690826	23889.17383	0.599101	20	200	7/8/2020 17:56
35042-11.2 TRP #1	0.0231	55.670258	2605.665039	-0.683816	23889.17383	0.599101	20	200	7/8/2020 17:59
35042-11.2 TRP #2	0.0228	55.135159	2582.582764	-0.325075	23889.17383	0.599101	20	200	7/8/2020 18:01
35042-12.2 #1	0.018	43.717628	2028.201294	-0.531845	23889.17383	0.599101	20	200	7/8/2020 18:03
35042-12.2 #2	0.0181	43.90839	2042.310791	-0.438535	23889.17383	0.599101	20	200	7/8/2020 18:05
35042-12.2 SPK #1	0.206	492.835907	23731.06055	-0.378451	23889.17383	0.599101	20	200	7/8/2020 18:07
35042-12.2 SPK #2	0.2064	493.740051	23590.26172	-1.301101	23889.17383	0.599101	20	200	7/8/2020 18:10
35042-14.2 #1	0.0002	1.655008	-568.803162	-1.655008	23889.17383	0.599101	20	82	7/8/2020 18:13
35042-14.2 #2	0	0.329806	-73.58947	0.024694	23889.17383	0.599101	20	82	7/8/2020 18:15
DL	0.0013	30.750113	1474.995728	0.150583	23889.17383	0.599101	1	1	7/8/2020 18:17
QC 2	0.0208	498.652496	23531.48438	-0.191966	23889.17383	0.599101	1	1	7/8/2020 18:19
BLK	0.0001	3.518335	48.269142	-0.866701	23889.17383	0.599101	1	1	7/8/2020 18:22
0	0	2.291525	95.635567	-0.164015	0	0 ----	----		7/9/2020 13:15
0.001	0.001	32.048923	1493.92749	-0.298914	29757.39844	2.291523 ----	----		7/9/2020 13:17
0.002	0.002	56.052933	2618.465332	-0.293022	26880.70117	3.250424 ----	----		7/9/2020 13:19
0.004	0.004	107.488907	5095.193848	-0.824311	26036.1582	3.907295 ----	----		7/9/2020 13:21
0.02	0.02	532.589844	25075.96875	-1.066057	26458.42188	3.218963 ----	----		7/9/2020 13:24
0.04	0.04	1054.334595	50283.69531	-1.152051	26294.8418	3.842058 ----	----		7/9/2020 13:26
BLK	0	4.99472	4.850766	-1.388144	26294.8418	3.842058	1	1	7/9/2020 13:29
DL	0.0012	36.176571	1670.988037	0.206905	26294.8418	3.842058	1	1	7/9/2020 13:31
QC 2	0.0205	543.907959	25706.40625	-0.389274	26294.8418	3.842058	1	1	7/9/2020 13:33
QC 3	0.02	528.996643	25040.79492	-0.811109	26294.8418	3.842058	1	1	7/9/2020 13:36
BLK	0	3.548355	-51.51627	-1.466087	26294.8418	3.842058	1	1	7/9/2020 13:38
35042-13.3 #1	0.0148	19.392298	990.675476	-0.124674	26294.8418	3.842058	20	500	7/9/2020 13:41
35042-13.3 #2	0.0066	10.736709	542.992188	-0.17491	26294.8418	3.842058	20	500	7/9/2020 13:43
35042-2.4 #1	0.0127	30.638464	1504.264893	-1.027251	26294.8418	3.842058	20	250	7/9/2020 13:49
35042-2.4 #2	0.0132	31.653187	1553.40625	-0.664424	26294.8418	3.842058	20	250	7/9/2020 13:52
35042-2.4 TRP #1	0.0117	28.381083	1521.022583	-0.644519	26294.8418	3.842058	20	250	7/9/2020 13:54
35042-2.4 TRP #2	0.0116	28.336145	1500.233887	-0.614634	26294.8418	3.842058	20	250	7/9/2020 13:56
35042-4.4 #1	0.0165	38.559231	1801.473389	-1.564059	26294.8418	3.842058	20	250	7/9/2020 14:08
35042-4.4 #2	0.0175	40.708572	2065.862061	-0.744684	26294.8418	3.842058	20	250	7/9/2020 14:10
DL	0.001	29.096972	1292.445801	-0.799898	26294.8418	3.842058	1	1	7/9/2020 14:21
QC 2	0.0196	520.53949	24841.29883	-0.269458	26294.8418	3.842058	1	1	7/9/2020 14:23
BLK	0	1.909307	-74.798912	-1.029927	26294.8418	3.842058	1	1	7/9/2020 14:26
35042-6.4 #1	0.0184	42.574566	2347.390137	-0.261683	26294.8418	3.842058	20	250	7/9/2020 14:28
35042-6.4 #2	0.0177	41.110149	2147.086426	-0.981289	26294.8418	3.842058	20	250	7/9/2020 14:30
35042-6.4 SPK #1	0.16	340.389557	18597.79297	-0.743194	26294.8418	3.842058	20	250	7/9/2020 14:32
35042-6.4 SPK #2	0.1586	337.532562	18599.01758	-1.897622	26294.8418	3.842058	20	250	7/9/2020 14:35
35042-7.4 #1	0.0139	33.016941	1556.322266	-1.858668	26294.8418	3.842058	20	250	7/9/2020 14:37
35042-7.4 #2	0.0148	34.889099	1767.72876	-0.978255	26294.8418	3.842058	20	250	7/9/2020 14:40
35042-8.4 #1	0.0185	42.700867	2215.087402	-1.222732	26294.8418	3.842058	20	250	7/9/2020 14:42
35042-8.4 #2	0.0182	42.029385	2151.558838	-1.091885	26294.8418	3.842058	20	250	7/9/2020 14:44
35042-8.4 TRP #1	0.0192	44.280499	2226.364502	-0.620068	26294.8418	3.842058	20	250	7/9/2020 14:46
35042-8.4 TRP #2	0.0194	44.645153	2229.127686	-0.660456	26294.8418	3.842058	20	250	7/9/2020 14:48

PS Analytical Millennium Galahad CVAF Analyzer

35042-9.4	#1	0.0391	86.039261	4322.623047	-0.812171	26294.8418	3.842058	20	250	7/9/2020 14:51
35042-9.4	#2	0.0381	83.988403	4198.736328	-1.146745	26294.8418	3.842058	20	250	7/9/2020 14:53
35042-9.4 SPK	#1	0.196	416.230896	22081.06445	-1.748609	26294.8418	3.842058	20	250	7/9/2020 14:55
35042-9.4 SPK	#2	0.1976	419.424652	22343.94141	-1.419466	26294.8418	3.842058	20	250	7/9/2020 14:58
DL		0.0008	25.588497	1044.782593	-2.002086	26294.8418	3.842058	1	1	7/9/2020 15:05
QC 2		0.0197	520.818237	24954.41797	-0.678547	26294.8418	3.842058	1	1	7/9/2020 15:07
BLK		0	2.360354	-21.407684	-1.335658	26294.8418	3.842058	1	1	7/9/2020 15:09
35042-13.4	#1	0.0086	21.871881	926.593384	-1.580225	26294.8418	3.842058	20	250	7/9/2020 15:30
35042-13.4	#2	0.0095	23.89085	1217.547974	-0.504749	26294.8418	3.842058	20	250	7/9/2020 15:32
35042-3.4 X2	#1	0.0292	34.596878	1711.619629	0.107978	26294.8418	3.842058	10	96	7/9/2020 15:38
35042-3.4 X2	#2	0.0282	33.518517	1643.80896	-0.741446	26294.8418	3.842058	10	96	7/9/2020 15:40
35042-3.4 X2 SF#1		0.2441	260.567627	12878.4502	-0.737458	26294.8418	3.842058	10	96	7/9/2020 15:42
35042-3.4 X2 SF#2		0.2402	256.484192	12579.05469	-1.183549	26294.8418	3.842058	10	96	7/9/2020 15:45
35042-1.4 X2	#1	0.0299	35.261982	1713.345947	-0.256435	26294.8418	3.842058	10	250	7/9/2020 15:59
35042-1.4 X2	#2	0.0271	32.318096	1524.154785	-0.620524	26294.8418	3.842058	10	250	7/9/2020 16:01
35042-6.4 X2	#1	0.0234	28.412659	1352.848511	-0.418884	26294.8418	3.842058	10	250	7/9/2020 16:25
35042-6.4 X2	#2	0.0233	28.369413	1347.802856	-0.831899	26294.8418	3.842058	10	250	7/9/2020 16:27
35042-6.4 2x SP#1		0.2357	251.77858	12341.75879	-0.800446	26294.8418	3.842058	10	250	7/9/2020 16:29
35042-6.4 2x SP#2		0.2364	252.459457	12275.00293	-0.889409	26294.8418	3.842058	10	250	7/9/2020 16:31
DL		0.001	30.67874	1439.145264	-0.671004	26294.8418	3.842058	1	1	7/9/2020 16:38
QC 2		0.0191	507.073334	24573.43359	-0.787518	26294.8418	3.842058	1	1	7/9/2020 16:40
BLK		0	2.197538	-28.583708	-1.072867	26294.8418	3.842058	1	1	7/9/2020 16:43
35042-10.4 X2	#1	0.0514	57.952274	2581.250732	-1.683522	26294.8418	3.842058	10	250	7/9/2020 17:03
35042-10.4 X2	#2	0.0546	61.287048	2922.522705	-0.946411	26294.8418	3.842058	10	250	7/9/2020 17:05
35042-11.4 X2	#1	0.0366	42.375252	1975.164551	-1.385172	26294.8418	3.842058	10	250	7/9/2020 17:07
35042-11.4 X2	#2	0.0369	42.702126	2016.917725	-0.703964	26294.8418	3.842058	10	250	7/9/2020 17:10
35042-11.4 TRP #1		0.0388	44.661465	2118.748047	-0.803151	26294.8418	3.842058	10	250	7/9/2020 17:12
35042-11.4 TRP #2		0.0374	43.203251	2067.076904	-1.003079	26294.8418	3.842058	10	250	7/9/2020 17:14
35042-12.4 X2	#1	0.0358	41.495895	2010.877441	-0.717765	26294.8418	3.842058	10	250	7/9/2020 17:16
35042-12.4 X2	#2	0.037	42.768517	2011.17688	-0.776513	26294.8418	3.842058	10	250	7/9/2020 17:18
35042-12.4 2x S #1		0.2495	266.243378	13305.02344	-1.021173	26294.8418	3.842058	10	250	7/9/2020 17:21
35042-12.4 2x S #2		0.2554	272.482117	13178.29297	-1.401954	26294.8418	3.842058	10	250	7/9/2020 17:23
DL		0.001	30.672729	1398.889526	-0.556412	26294.8418	3.842058	1	1	7/9/2020 17:34
QC 2		0.0198	524.010437	24895.1875	-0.251715	26294.8418	3.842058	1	1	7/9/2020 17:36
BLK		0	1.284478	-73.804993	-1.284478	26294.8418	3.842058	1	1	7/9/2020 17:39
0		0	2.95959	153.472092	0.116719	0	0 ----	----		7/14/2020 15:35
0.002		0.002	45.116684	2049.472656	-0.658599	21078.54688	8.410879 ----	----		7/14/2020 15:40
0.004		0.004	89.816383	4144.929688	-0.34137	20330.5957	8.99262 ----	----		7/14/2020 15:42
0.02		0.02	442.66507	20343.11719	-0.548732	21766.2207	6.652355 ----	----		7/14/2020 15:44
0.04		0.04	873.022644	39678.9375	-0.963242	21669.30078	7.021545 ----	----		7/14/2020 15:46
0.001		0.001	29.995083	1425.251221	0.207707	21752.34375	4.361379 ----	----		7/14/2020 15:53
DL		0.0012	30.610422	1411.226929	-0.00712	21752.34375	4.361379	1	1	7/14/2020 15:57
QC 2		0.0196	430.579773	19914.43359	-0.27681	21752.34375	4.361379	1	1	7/14/2020 16:00
QC 3		0.0193	424.074615	19699.04297	-1.160386	21752.34375	4.361379	1	1	7/14/2020 16:02
BLK		0	1.061519	-211.645065	-1.058887	21752.34375	4.361379	1	1	7/14/2020 16:04
35042-5.4	#1	0.0248	47.601597	2382.497314	-0.124891	21752.34375	4.361379	20	250	7/14/2020 16:06
35042-5.4	#2	0.0208	40.53598	1980.727905	-0.733896	21752.34375	4.361379	20	250	7/14/2020 16:09
35042-5.4 TRP	#1	0.0206	40.140877	2010.597412	-0.191275	21752.34375	4.361379	20	250	7/14/2020 16:11
35042-5.4 TRP	#2	0.0196	38.53212	1945.619019	-0.623076	21752.34375	4.361379	20	250	7/14/2020 16:13
35042-9.4	#1	0.0143	16.822781	785.862854	-0.509563	21752.34375	4.361379	10	250	7/14/2020 16:15
35042-9.4	#2	0.0134	15.982473	795.356201	-0.209494	21752.34375	4.361379	10	250	7/14/2020 16:17
35042-9.4 SPK	#1	0.4674	411.060181	18765.51758	-0.039248	21752.34375	4.361379	10	250	7/14/2020 16:20

PS Analytical Millennium Galahad CVAF Analyzer

35042-9.4 SPK #2	0.4554	400.587097	18256.875	-1.034748	21752.34375	4.361379	10	250	7/14/2020 16:22
35042-14.4 #1	0.0053	28.231531	1281.005615	-0.597895	21752.34375	4.361379	20	96	7/14/2020 16:24
35042-14.4 #2	0.0054	28.756645	1411.74707	-0.441758	21752.34375	4.361379	20	96	7/14/2020 16:27
QC 2	0.022	483.578674	22481.91016	-0.417605	21752.34375	4.361379	1	1	7/14/2020 16:54
BLK	0.0004	13.340321	493.895325	-1.073872	21752.34375	4.361379	1	1	7/14/2020 16:57
0	0	8.48584	406.347778	0.069779	0	0	----	----	7/15/2020 15:27
0.001	0.001	31.919811	1497.006836	0.043774	23433.9707	8.48584	----	----	7/15/2020 15:29
0.002	0.002	54.512497	2544.239746	-0.437151	23013.32422	8.626059	----	----	7/15/2020 15:31
0.004	0.004	100.879059	4641.435059	-0.682949	23064.67578	8.58612	----	----	7/15/2020 15:33
0.02	0.02	485.264893	22568.26953	-0.780692	23880.89844	7.255578	----	----	7/15/2020 15:36
0.04	0.04	948.873108	44145.98047	-1.194934	23572.4043	8.430709	----	----	7/15/2020 15:38
0.001	0.001	31.309061	1215.414673	-1.573022	23576.8457	8.288398	----	----	7/15/2020 15:41
BLK	0	6.909958	315.598816	-0.411217	23572.4043	8.430709	1	1	7/15/2020 15:45
DL	0.001	31.885616	1458.895874	-0.071811	23572.4043	8.430709	1	1	7/15/2020 15:47
QC 2	0.0213	510.288879	23251.3457	-0.279302	23572.4043	8.430709	1	1	7/15/2020 15:49
QC 3	0.0214	513.295898	23233.99219	-0.977785	23572.4043	8.430709	1	1	7/15/2020 15:52
BLK	0	3.338038	-137.448349	-1.382448	23572.4043	8.430709	1	1	7/15/2020 15:54
35042-13.5 #1	0.0166	21.510614	1101.10498	-0.256105	23572.4043	8.430709	20	600	7/15/2020 15:56
35042-13.5 #2	0.0149	20.121815	1033.197998	-0.294788	23572.4043	8.430709	20	600	7/15/2020 15:59
35042-14.5 #1	0.0076	88.505745	4139.966309	-0.026906	23572.4043	8.430709	20	45	7/15/2020 16:01
35042-14.5 #2	0.0074	86.133324	3978.077881	-0.863477	23572.4043	8.430709	20	45	7/15/2020 16:03
35042-LRB FIL #1	0.0005	10.742768	425.447937	-1.03396	23572.4043	8.430709	10	50	7/15/2020 16:05
35042-LRB FIL #2	0.0003	9.663529	451.061951	0.115524	23572.4043	8.430709	10	50	7/15/2020 16:07
35042-LRB FIL #1	0.0921	225.587585	10880.91406	0.222021	23572.4043	8.430709	5	50	7/15/2020 16:09
35042-LRB FIL #2	0.0926	226.639709	10660.8916	-0.287171	23572.4043	8.430709	5	50	7/15/2020 16:12
35042-1.1 #1	0.0149	78.551109	3410.722412	-1.938609	23572.4043	8.430709	10	50	7/15/2020 16:14
35042-1.1 #2	0.014	74.281944	3396.921875	-0.763939	23572.4043	8.430709	10	50	7/15/2020 16:16
35042-2.1 #1	0.0512	249.896164	11556.3291	-0.358613	23572.4043	8.430709	10	50	7/15/2020 16:18
35042-2.1 #2	0.0504	246.139954	11343.68262	-1.233723	23572.4043	8.430709	10	50	7/15/2020 16:21
35042-2.1 TRP #1	0.0513	250.26976	11241.99023	-1.660327	23572.4043	8.430709	10	50	7/15/2020 16:23
35042-2.1 TRP #2	0.0511	249.167313	11376.20606	-1.907956	23572.4043	8.430709	10	50	7/15/2020 16:25
35042-3.1 #1	0.0871	419.170593	18901.15625	-1.43619	23572.4043	8.430709	10	50	7/15/2020 16:27
35042-3.1 #2	0.0834	401.652679	18407.83008	-0.395669	23572.4043	8.430709	10	50	7/15/2020 16:29
35042-3.1 SPK #1	0.1772	843.991211	37573.73438	-1.225538	23572.4043	8.430709	10	50	7/15/2020 16:32
35042-3.1 SPK #2	0.1756	836.455444	37223.64063	-1.323259	23572.4043	8.430709	10	50	7/15/2020 16:34
DL	0.0006	23.26251	636.571167	-1.317992	23572.4043	8.430709	1	1	7/15/2020 16:36
QC 2	0.0208	499.533966	23082.87109	-0.105364	23572.4043	8.430709	1	1	7/15/2020 16:38
BLK	0	2.294851	-172.442673	-1.49172	23572.4043	8.430709	1	1	7/15/2020 16:41
35042-4.1 #1	0.0944	453.509796	19324.4375	-0.249088	23572.4043	8.430709	10	50	7/15/2020 16:43
35042-4.1 #2	0.0892	428.740173	17858.39453	-0.089916	23572.4043	8.430709	10	50	7/15/2020 16:45
35042-5.1 #1	0.0058	35.931999	1344.122314	-1.178328	23572.4043	8.430709	10	50	7/15/2020 16:48
35042-5.1 #2	0.0056	34.715466	1526.318359	-0.316747	23572.4043	8.430709	10	50	7/15/2020 16:50
35042-5.1 TRP #1	0.0053	33.399769	1442.078491	0.027637	23572.4043	8.430709	10	50	7/15/2020 16:52
35042-5.1 TRP #2	0.0052	33.02301	1469.192383	-0.015837	23572.4043	8.430709	10	50	7/15/2020 16:54
35042-9.1 #1	0.0043	28.689199	1302.177002	-0.35066	23572.4043	8.430709	10	50	7/15/2020 17:19
35042-9.1 #2	0.0041	27.636862	1276.862183	-0.296598	23572.4043	8.430709	10	50	7/15/2020 17:21
35042-9.1 SPK #1	0.0759	366.031525	16599.76563	-0.272545	23572.4043	8.430709	10	50	7/15/2020 17:23
35042-9.1 SPK #2	0.0769	371.037384	16399.89648	-0.501249	23572.4043	8.430709	10	50	7/15/2020 17:25
DL	0.0007	25.034538	973.748474	-1.38308	23572.4043	8.430709	1	1	7/15/2020 17:28
QC 2	0.0203	487.944366	22583.45117	-0.350566	23572.4043	8.430709	1	1	7/15/2020 17:30
BLK	0	2.412423	-23.433176	-0.816193	23572.4043	8.430709	1	1	7/15/2020 17:32
35042-11.1 #1	0.0424	208.369843	9505.49707	-0.445163	23572.4043	8.430709	10	50	7/15/2020 17:39

PS Analytical Millennium Galahad CVAF Analyzer

35042-11.1	#2	0.0415	204.22377	9224.461914	-0.809895	23572.4043	8.430709	10	50	7/15/2020 17:41
35042-11.1 TRP #1		0.0411	202.140823	9159.462891	-0.969309	23572.4043	8.430709	10	50	7/15/2020 17:43
35042-11.1 TRP #2		0.0406	199.685547	8985.182617	-1.283232	23572.4043	8.430709	10	50	7/15/2020 17:45
35042-12.1	#1	0.0063	38.012028	1656.750122	-1.102635	23572.4043	8.430709	10	50	7/15/2020 17:48
35042-12.1	#2	0.0066	39.408749	1839.575439	-0.516851	23572.4043	8.430709	10	50	7/15/2020 17:50
35042-12.1 SPK #1		0.0951	456.864716	20983.87891	-0.361912	23572.4043	8.430709	10	50	7/15/2020 17:52
35042-12.1 SPK #2		0.0961	461.314209	21199.30469	-1.162879	23572.4043	8.430709	10	50	7/15/2020 17:55
35042-14.1	#1	0	1.482605	-163.043777	-0.853782	23572.4043	8.430709	10	50	7/15/2020 17:57
35042-14.1	#2	0	5.707588	268.289246	-0.195076	23572.4043	8.430709	10	50	7/15/2020 17:59
35042-14.6	#1	0.0361	139.436844	6725.081055	-0.308716	23572.4043	8.430709	20	130	7/15/2020 18:01
35042-14.6	#2	0.0359	138.708954	6571.375977	-0.981508	23572.4043	8.430709	20	130	7/15/2020 18:03
DL		0.0008	26.622185	1085.990845	-1.940566	23572.4043	8.430709	1	1	7/15/2020 18:06
QC 2		0.0203	487.070984	23061.22266	-0.292149	23572.4043	8.430709	1	1	7/15/2020 18:08
BLK		0	1.984565	-25.528978	-0.574371	23572.4043	8.430709	1	1	7/15/2020 18:10
DL		0.0007	25.035202	1015.170044	-0.98021	23572.4043	8.430709	1	1	7/16/2020 10:28
QC 2		0.0179	431.354736	20037.06055	0.249987	23572.4043	8.430709	1	1	7/16/2020 10:32
QC 3		0.0183	440.247223	20323.35938	-0.395107	23572.4043	8.430709	1	1	7/16/2020 10:35
BLK		0	2.920509	-80.646042	-0.284873	23572.4043	8.430709	1	1	7/16/2020 10:37
35042-8.1 TRP #1		0	6.756227	271.631622	0.14897	23572.4043	8.430709	10	50	7/16/2020 10:44
35042-8.1 TRP #2		0	0.198737	-83.331131	0.001275	23572.4043	8.430709	10	50	7/16/2020 10:46
35042-10.1	#1	0.009	50.966423	2412.114746	0.068436	23572.4043	8.430709	10	50	7/16/2020 10:48
35042-10.1	#2	0.0084	47.891747	2221.022461	-0.287338	23572.4043	8.430709	10	50	7/16/2020 10:50
DL		0.0008	26.332876	1173.015503	-0.524549	23572.4043	8.430709	1	1	7/16/2020 10:52
QC 3		0.0186	445.747314	20670.88867	-0.352853	23572.4043	8.430709	1	1	7/16/2020 10:55
BLK		0	2.626437	-21.537449	-1.120845	23572.4043	8.430709	1	1	7/16/2020 10:57
35042-8.1 TRP #1		0.0049	31.717813	1489.318359	-0.737955	23572.4043	8.430709	10	50	7/16/2020 11:07
35042-8.1 TRP #2		0.0047	30.619392	1443.2948	-0.125458	23572.4043	8.430709	10	50	7/16/2020 11:09
35042-7.1	#1	0.3025	721.544128	34473.8125	-0.829997	23572.4043	8.430709	5	50	7/16/2020 11:20
35042-7.1	#2	0.3093	737.433655	35505.82031	-2.043649	23572.4043	8.430709	5	50	7/16/2020 11:23
35042-6.1 X2	#1	0.1463	180.858185	8396.361328	-1.839385	23572.4043	8.430709	2.5	50	7/16/2020 11:38
35042-6.1 X2	#2	0.1418	175.538086	8106.373535	-1.894416	23572.4043	8.430709	2.5	50	7/16/2020 11:41
35042-6.1 X2 SF#1		0.324	390.31366	18230.62109	-1.919997	23572.4043	8.430709	2.5	50	7/16/2020 11:43
35042-6.1 X2 SF#2		0.3321	399.880493	18397.57031	-0.536788	23572.4043	8.430709	2.5	50	7/16/2020 11:45
DL		0.0007	25.526398	927.197266	-0.638535	23572.4043	8.430709	1	1	7/16/2020 11:47
QC 3		0.0193	462.474121	21491.27734	-0.305709	23572.4043	8.430709	1	1	7/16/2020 11:50
BLK		0	2.839211	-15.673859	-1.011086	23572.4043	8.430709	1	1	7/16/2020 11:52
35042-9.1 X2	#1	0.0041	13.25531	640.674866	0.056839	23572.4043	8.430709	2.5	50	7/16/2020 11:54
35042-9.1 X2	#2	0.0027	11.636095	534.733215	-0.551722	23572.4043	8.430709	2.5	50	7/16/2020 11:56
35042-9.1 X2 SF#1		0.1805	221.172043	10326.81348	-0.18144	23572.4043	8.430709	2.5	50	7/16/2020 11:59
35042-9.1 X2 SF#2		0.1763	216.277786	10109.83398	-0.3528	23572.4043	8.430709	2.5	50	7/16/2020 12:01
DL		0.0007	24.941465	990.933838	-1.027669	23572.4043	8.430709	1	1	7/16/2020 12:03
QC 3		0.0193	462.248383	21397.53125	-0.257835	23572.4043	8.430709	1	1	7/16/2020 12:05
BLK		0	2.365863	-28.193439	-1.165035	23572.4043	8.430709	1	1	7/16/2020 12:08

## PerkinElmer FIMS-100 CVAA Mercury Analyzer

Sample_ID	Date	Time	Mean_Sig	Mean_ST	Mean_SA	Units	Alq.	Vol.	Sig 1	Std_U 1	Smp_U 1	Sig 2	Std_U 2	Smp_U 2	Corr. Coeff.
Calib Blank	7/16/2020	9:19:48 AM	6.30E-05			µg			7.16E-05			5.44E-05			
STD1 = .004ug	7/16/2020	9:21:29 AM	0.00038052			µg			0.00038029			0.00038075			
STD2 = .04ug	7/16/2020	9:23:11 AM	0.00429054			µg			0.00432123			0.00425985			
STD3 = .08ug	7/16/2020	9:24:54 AM	0.0089269			µg			0.00899274			0.00886106			
STD4 = .16ug	7/16/2020	9:26:38 AM	0.01783467			µg			0.01782324			0.0178461			
STD5 = .2ug	7/16/2020	9:28:32 AM	0.02153321			µg			0.02163596			0.02143046			
Reagent Blank	7/16/2020	9:30:24 AM	0.00010051	0.00091919	0.00091919	µg			0.00011334	0.00103648	0.00103648	8.77E-05	0.0008019	0.0008019	
0.004ug = DL	7/16/2020	9:32:06 AM	0.00047457	0.00433994	0.00433994	µg			0.00048903	0.0044721	0.0044721	0.00046012	0.00420777	0.00420777	0.999577565
0.080ug = QC STD 3	7/16/2020	9:33:48 AM	0.00920457	0.08417478	0.08417478	µg			0.00930619	0.0851041	0.0851041	0.00910294	0.08324546	0.08324546	0.999577565
0.080ug = QC STD 2	7/16/2020	9:35:41 AM	0.00925107	0.08460006	0.08460006	µg			0.00922075	0.08432278	0.08432278	0.00928139	0.08487734	0.08487734	0.999577565
0.080ug = QC STD 2	7/16/2020	9:37:34 AM	0.00917455	0.08390028	0.08390028	µg			0.00916504	0.08381335	0.08381335	0.00918405	0.0839872	0.0839872	0.999577565
Reagent Blank	7/16/2020	9:39:26 AM	2.39E-05	0.00021822	0.00021822	µg			2.65E-05	0.00024207	0.00024207	2.13E-05	0.00019437	0.00019437	0.999577565
35042-1.5	7/16/2020	9:53:36 AM	0.00197782	0.01716773	2.57515898	µg	4	600	0.00197426	0.01713518	2.57027731	0.00198137	0.01720027	2.58004065	0.999577565
35042-2.5	7/16/2020	9:55:21 AM	0.00184642	0.01596616	2.39492409	µg	4	600	0.00185117	0.01600952	2.40142797	0.00184168	0.0159228	2.3884202	0.999577565
35042-2.5 TRP	7/16/2020	9:57:05 AM	0.0018389	0.01589737	2.38460558	µg	4	600	0.00183987	0.01590623	2.38593417	0.00183793	0.01588851	2.38327699	0.999577565
0.004ug = DL	7/16/2020	9:58:49 AM	0.00045964	0.00420333	0.00420333	µg			0.00050992	0.00466315	0.00466315	0.00040935	0.0037435	0.0037435	0.999577565
0.080ug = QC STD 2	7/16/2020	10:00:31 AM	0.00912352	0.08343361	0.08343361	µg			0.00911525	0.08335796	0.08335796	0.00913179	0.08350925	0.08350925	0.999577565
Reagent Blank	7/16/2020	10:02:22 AM	0.00013591	0.00124292	0.00124292	µg			-1.28E-05	-0.0001171	-0.0001171	0.00028464	0.00260299	0.00260299	0.999577565
35042-3.5	7/16/2020	10:04:04 AM	0.00176667	0.01523682	2.28552317	µg	4	600	0.00172582	0.01486328	2.22949145	0.00180752	0.01561037	2.34155488	0.999577565
35042-3.5 SPK	7/16/2020	10:05:47 AM	0.01088029	0.09857989	14.7869831	µg	4	600	0.01087549	0.09853604	14.7804064	0.01088508	0.09862373	14.7935597	0.999577565
35042-4.5	7/16/2020	10:07:41 AM	0.00247562	0.02172008	3.25801275	µg	4	600	0.00247824	0.02174401	3.26160127	0.002473	0.02169616	3.25442422	0.999577565
35042-5.5	7/16/2020	10:09:24 AM	0.00241625	0.02117712	3.17656875	µg	4	600	0.00240795	0.02110123	3.16518492	0.00242455	0.02125302	3.18795257	0.999577565
35042-5.5 TRP	7/16/2020	10:11:07 AM	0.00227077	0.01984674	2.97701168	µg	4	600	0.0022671	0.01981323	2.97198444	0.00227443	0.01988026	2.98203892	0.999577565
35042-6.5	7/16/2020	10:12:49 AM	0.00234549	0.02053005	3.07950741	µg	4	600	0.00233361	0.02042138	3.06320689	0.00235737	0.02063872	3.09580793	0.999577565
35042-6.5 SPK	7/16/2020	10:14:33 AM	0.01103341	0.09998017	14.997025	µg	4	600	0.01107312	0.10034331	15.0514971	0.0109937	0.09961702	14.9425529	0.999577565
35042-7.5	7/16/2020	10:16:27 AM	0.00355407	0.03158237	4.73735613	µg	4	600	0.00360876	0.03208256	4.81238455	0.00349937	0.03108218	4.66232771	0.999577565
35042-8.5	7/16/2020	10:18:10 AM	0.00292876	0.02586405	4.52620856	µg	4	700	0.00292236	0.02580548	4.51595918	0.00293517	0.02592262	4.53645794	0.999577565
35042-8.5 TRP	7/16/2020	10:19:55 AM	0.00290533	0.02564975	4.48870684	µg	4	700	0.00290496	0.02564635	4.48811065	0.0029057	0.02565316	4.48930304	0.999577565
0.004ug = DL	7/16/2020	10:21:38 AM	0.00046247	0.00422923	0.00422923	µg			0.00047356	0.00433069	0.00433069	0.00045137	0.00412776	0.00412776	0.999577565
0.080ug = QC STD 2	7/16/2020	10:23:20 AM	0.00917129	0.08387045	0.08387045	µg			0.00922239	0.08433782	0.08433782	0.00912018	0.08340307	0.08340307	0.999577565
Reagent Blank	7/16/2020	10:25:13 AM	2.38E-05	0.00021749	0.00021749	µg			2.83E-05	0.00025851	0.00025851	1.93E-05	0.00017646	0.00017646	0.999577565
35042-9.5	7/16/2020	10:26:55 AM	0.00333164	0.02954833	4.43224921	µg	4	600	0.00335567	0.02976807	4.46520984	0.00330761	0.02932859	4.39928859	0.999577565
35042-9.5 SPK	7/16/2020	10:28:40 AM	0.01119848	0.10148974	15.2234605	µg	4	600	0.01118007	0.10132141	15.1982116	0.01121689	0.10165806	15.2487095	0.999577565
35042-10.5	7/16/2020	10:30:34 AM	0.00564431	0.05069743	8.87205019	µg	4	700	0.0056399	0.0506571	8.86499178	0.00564872	0.05073776	8.8791086	0.999577565
35042-11.5	7/16/2020	10:32:18 AM	0.00595396	0.05352919	8.02937783	µg	4	600	0.0059563	0.05355052	8.03257788	0.00595163	0.05350785	8.02617777	0.999577565
35042-11.5 TRP	7/16/2020	10:34:01 AM	0.00600328	0.05398014	8.09702061	µg	4	600	0.00602388	0.05416859	8.12528813	0.00598267	0.05379169	8.06875308	0.999577565
35042-12.5	7/16/2020	10:35:44 AM	0.00591516	0.0531743	7.97614479	µg	4	600	0.00592393	0.0532545	7.98817455	0.00590639	0.0530941	7.96411504	0.999577565
35042-12.5 SPK	7/16/2020	10:37:28 AM	0.0157397	0.14301871	21.4528063	µg	4	600	0.01572529	0.14288692	21.4330376	0.01575411	0.1431505	21.4725749	0.999577565
0.004ug = DL	7/16/2020	10:44:52 AM	0.00042244	0.00386318	0.00386318	µg			0.00042578	0.00389374	0.00389374	0.0004191	0.00383262	0.00383262	0.999577565
0.080ug = QC STD 2	7/16/2020	10:46:34 AM	0.00955691	0.08739693	0.08739693	µg			0.00952151	0.08707324	0.08707324	0.0095923	0.08772062	0.08772062	0.999577565
Reagent Blank	7/16/2020	10:48:26 AM	2.43E-06	2.22E-05	2.22E-05	µg			1.51E-05	0.00013788	0.00013788	-1.02E-05	-9.35E-05	-9.35E-05	0.999577565

## Appendix D

### Calibration Data



# Routine Dry Gas Meter Calibration

Control Module: C-14  
DGM S/N : 17087358  
Date : 6/22/2020  
Technician : DJK

Leak checks  
Negative Pass 15 in. Hg  
Positive : Pass > 5 in. W.C

Barometric Press. : 28.43  
Previous Y : 0.9802  
Previous dH@ : 2.0363

Orifice Diff Pressure, in. W.C.	Wet Test Volume, Ft <sup>3</sup>	Dry Gas Meter Temp, °F		Wet Test Meter Temp, °F	Dry Gas Volume Ft <sup>3</sup>	Elapsed Time of Cal. Point		Meter Coefficient Y	Orifice Coefficient dH@
		Inlet	Outlet						
Nominal 0.50	Initial 3221.00	Initial 74.0	Initial 74.0	Initial 74.5	Initial 416.890				
Actual 0.50	Final 3231.00	Final 76.0	Final 76.0	Final 74.5	Final 427.010	Minutes 25	Sec. 52		
	Total 10.00	Average 75.0	Average 75.0	Average 74.5	Total 10.120	Minutes 25.87		0.9878	2.0045
		75.0	Tm						
Nominal 1.00	Initial 3232.00	Initial 77.0	Initial 77.0	Initial 74.5	Initial 428.020				
Actual 1.00	Final 3241.00	Final 78.0	Final 78.0	Final 74.5	Final 437.180	Minutes 16	Sec. 36		
	Total 9.00	Average 77.5	Average 77.5	Average 74.5	Total 9.160	16.60		0.9855	2.0289
		77.5	Tm						
Nominal 2.00	Initial 3206.00	Initial 70.0	Initial 70.0	Initial 75.5	Initial 401.770				
Actual 2.00	Final 3219.00	Final 73.0	Final 73.0	Final 74.5	Final 414.860	Minutes 17	Sec. 3		
	Total 13.00	Average 71.5	Average 71.5	Average 75.0	Total 13.090	17.05		0.9816	2.0788
		71.5	Tm						
Nominal 3.00	Initial 3242.00	Initial 78.0	Initial 78.0	Initial 74.5	Initial 438.180				
Actual 3.00	Final 3261.00	Final 80.0	Final 80.0	Final 74.5	Final 457.550	Minutes 20	Sec. 14		
	Total 19.00	Average 79.0	Average 79.0	Average 74.5	Total 19.370	20.23		0.9815	2.0233
		79.0	Tm						
Nominal 4.00	Initial 3262.00	Initial 80.0	Initial 80.0	Initial 74.5	Initial 458.560				
Actual 4.00	Final 3274.00	Final 81.0	Final 81.0	Final 74.0	Final 470.830	Minutes 11	Sec. 5		
	Total 12.00	Average 80.5	Average 80.5	Average 74.3	Total 12.270	11.08		0.9793	2.0218
		80.5	Tm						
Average								0.9831	2.0315

Reviewed By: *Tom Kulinski*



# Routine Dry Gas Meter Calibration

Control Module: C-6  
DGM S/N : \_\_\_\_\_  
Date : 6/22/2020  
Technician : DJK

Leak checks  
Negative Pass 15 in. Hg  
Positive : Pass > 5 in. W.C

Barometric Press. : 28.43  
Previous Y : 0.9921  
Previous dH@ : 1.7402

Orifice Diff Pressure, in. W.C.	Wet Test Volume, Ft³	Dry Gas Meter Temp, °F		Wet Test Meter Temp, °F	Dry Gas Volume Ft³	Elapsed Time of Cal. Point		Meter Coefficient Y	Orifice Coefficient dH@
		Inlet	Outlet						
Nominal 0.50	Initial 3290.00	Initial 81.0	Initial 75.0	Initial 73.5	Initial 965.430			0.9837	1.6195
Actual	Final 3297.00	Final 82.0	Final 78.0	Final 73.5	Final 972.610	Minutes 16	Sec. 22		
0.50	Total 7.00	Average 81.5	Average 76.5	Average 73.5	Total 7.180	Minutes 16.37			
		79.0 Tm							
Nominal 1.00	Initial 3298.00	Initial 83.0	Initial 78.0	Initial 74.0	Initial 973.700			0.9808	1.6495
Actual	Final 3306.00	Final 85.0	Final 80.0	Final 74.0	Final 981.950	Minutes 13	Sec. 22		
1.00	Total 8.00	Average 84.0	Average 79.0	Average 74.0	Total 8.250	13.37			
		81.5 Tm							
Nominal 2.00	Initial 3278.00	Initial 75.0	Initial 75.0	Initial 74.0	Initial 953.140			0.9812	1.8037
Actual	Final 3289.00	Final 81.0	Final 75.0	Final 73.5	Final 964.350	Minutes 13	Sec. 32		
2.00	Total 11.00	Average 78.0	Average 75.0	Average 73.8	Total 11.210	13.53			
		76.5 Tm							
Nominal 3.00	Initial 3307.00	Initial 85.0	Initial 80.0	Initial 74.0	Initial 983.040			0.9786	1.8134
Actual	Final 3320.00	Final 87.0	Final 82.0	Final 74.5	Final 996.450	Minutes 13	Sec. 10		
3.00	Total 13.00	Average 86.0	Average 81.0	Average 74.3	Total 13.410	13.17			
		83.5 Tm							
Nominal 4.00	Initial 3321.00	Initial 87.0	Initial 82.0	Initial 74.5	Initial 997.560			0.9765	1.8259
Actual	Final 3333.00	Final 87.0	Final 82.0	Final 74.5	Final 1009.950	Minutes 10	Sec. 34		
4.00	Total 12.00	Average 87.0	Average 82.0	Average 74.5	Total 12.390	10.57			
		84.5 Tm							
Average								0.9802	1.7424

Reviewed By: *Tom Kulinski*



Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Indurating Furnace Stack A (SV014)  
Control Module C-6

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	6/23/2020	6/23/2020	6/23/2020
Test period	-	-	0808 - 1015	1035 - 1242	1311 - 1519
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	89.0	89.9	88.4
Average dry gas meter temp	T <sub>m</sub>	°F	69.7	75.4	78.3
Absolute average dry gas meter temp	T <sub>m</sub>	°R	529.4	535.0	538.0
Barometric pressure	P <sub>b</sub>	inches Hg	28.3	28.3	28.3
Conversion factor (29.92/528)(0.75) <sup>2</sup>	---	(in Hg/°R) cfm <sup>2</sup>	0.0319	0.0319	0.0319
Average orifice meter differential	Δ h <sub>avg</sub>	in. H <sub>2</sub> O	1.57	1.60	1.57
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	1.74	1.74	1.74
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	29.00	29.00	29.00
Dry molecular weight of air	---	lb/lb-mole	29.00	29.00	29.00
Specific gravity of mercury	---	Dimensionless	13.60	13.60	13.60
Dry gas meter calibration check value	Y <sub>qa</sub>	Dimensionless	0.9873	0.9914	1.0027
Dry gas meter calibration factor	Y	Dimensionless	0.9802	0.9802	0.9802
Average of Y <sub>qa</sub> 's from test run series	<b>0.9938</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \cdot (\sqrt{\Delta h_{avg}})}$			
Dry gas meter calibration factor	<b>0.9802</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-1.38%</b>				
(must be within ± 5%)					

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Indurating Furnace Stack B (SV015)  
Control Module C-6

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	6/24/2020	6/24/2020	6/24/2020
Test period	-	-	0810 - 1016	1040 - 1245	1300 - 1506
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	90.6	89.2	91.6
Average dry gas meter temp	T <sub>m</sub>	°F	70.5	76.8	81.1
Absolute average dry gas meter temp	T <sub>m</sub>	°R	530.2	536.5	540.8
Barometric pressure	P <sub>b</sub>	inches Hg	28.2	28.2	28.2
Conversion factor (29.92/528)(0.75) <sup>2</sup>	---	(in Hg/°R) cfm <sup>2</sup>	0.0319	0.0319	0.0319
Average orifice meter differential	Δ h <sub>avg</sub>	in. H <sub>2</sub> O	1.62	1.59	1.62
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	1.74	1.74	1.74
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	29.06	29.06	29.06
Dry molecular weight of air	---	lb/lb-mole	29.00	29.00	29.00
Specific gravity of mercury	---	Dimensionless	13.60	13.60	13.60
Dry gas meter calibration check value	Y <sub>qa</sub>	Dimensionless	0.9866	0.9984	0.9844
Dry gas meter calibration factor	Y	Dimensionless	0.9802	0.9802	0.9802
Average of Y <sub>qa</sub> 's from test run series	<b>0.9898</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \cdot (\sqrt{\Delta h_{avg}})}$			
Dry gas meter calibration factor	<b>0.9802</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-0.98%</b>				
(must be within ± 5%)					

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Indurating Furnace Stack C (SV016)  
Control Module C-14

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	6/23/2020	6/23/2020	6/23/2020
Test period	-	-	0808 - 1015	1035 - 1242	1311 - 1519
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	74.6	73.9	74.3
Average dry gas meter temp	T <sub>m</sub>	°F	64.0	69.5	71.9
Absolute average dry gas meter temp	T <sub>m</sub>	°R	523.6	529.2	531.6
Barometric pressure	P <sub>b</sub>	inches Hg	28.3	28.3	28.3
Conversion factor (29.92/528)(0.75) <sup>2</sup>	---	(in Hg/°R) cfm <sup>2</sup>	0.0319	0.0319	0.0319
Average orifice meter differential	Δ h <sub>avg</sub>	in. H <sub>2</sub> O	1.32	1.29	1.29
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	2.03	2.03	2.03
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	29.10	29.10	29.10
Dry molecular weight of air	---	lb/lb-mole	29.00	29.00	29.00
Specific gravity of mercury	---	Dimensionless	13.60	13.60	13.60
Dry gas meter calibration check value	Y <sub>qa</sub>	Dimensionless	0.9950	0.9981	0.9932
Dry gas meter calibration factor	Y	Dimensionless	0.9831	0.9831	0.9831
Average of Y <sub>qa</sub> 's from test run series	<b>0.9955</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \cdot (\sqrt{\Delta h_{avg}})}$			
Dry gas meter calibration factor	<b>0.9831</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-1.26%</b>				
(must be within ± 5%)					

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Indurating Furnace Stack D (SV017)  
Control Module C-14

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	6/24/2020	6/24/2020	6/24/2020
Test period	-	-	0810 - 1016	1040 - 1245	1300 - 1506
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	86.6	85.3	85.2
Average dry gas meter temp	T <sub>m</sub>	°F	64.8	70.4	75.1
Absolute average dry gas meter temp	T <sub>m</sub>	°R	524.4	530.1	534.8
Barometric pressure	P <sub>b</sub>	inches Hg	28.2	28.2	28.2
Conversion factor (29.92/528)(0.75) <sup>2</sup>	---	(in Hg/°R) cfm <sup>2</sup>	0.0319	0.0319	0.0319
Average orifice meter differential	Δ h <sub>avg</sub>	in. H <sub>2</sub> O	1.77	1.71	1.69
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	2.03	2.03	2.03
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	29.15	29.15	29.15
Dry molecular weight of air	---	lb/lb-mole	29.00	29.00	29.00
Specific gravity of mercury	---	Dimensionless	13.60	13.60	13.60
Dry gas meter calibration check value	Y <sub>qa</sub>	Dimensionless	0.9923	0.9955	0.9929
Dry gas meter calibration factor	Y	Dimensionless	0.9831	0.9831	0.9831
Average of Y <sub>qa</sub> 's from test run series	<b>0.9936</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \cdot (\sqrt{\Delta h_{avg}})}$			
Dry gas meter calibration factor	<b>0.9831</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-1.07%</b>				
(must be within ± 5%)					

# Meter Pyrometer Calibration

Meter I.D.		C-14					
Temperature	CL-300-100F						
Calibrator Used	CL-3512-A	X	X	X	X	X	X
DATE		1/2/2020	1/2/2020	1/2/2020	1/2/2020	1/2/2020	1/2/2020
TECHNICIAN		RMP	RMP	RMP	RMP	RMP	RMP
Thermocouple I.D.		T.C. 1	T.C. 2	T.C. 3	T.C. 4	T.C. 5	T.C. 6
Reference °F	Acceptable Range	** If not within Acceptable Range, unit not to be used within range at which failure occurred.					
1950	1932 to 1968	1955				1956	1956
1800	1784 to 1816	1802				1802	1802
1600	1585 to 1615	1604				1604	1604
1400	1387 to 1413	1401				1401	1401
1200	1188 to 1212	1194				1204	1204
1000	990 to 1010	1002				1002	1002
900	890 to 910	902				902	901
800	791 to 809	801				802	802
700	692 to 708	703				703	703
600	593 to 607	600				600	600
500	493 to 507	498	498	498		498	498
400	394 to 406	398	398	398		398	398
300	295 to 305	299	299	299		299	299
200	196 to 204	199	199	199		199	199
150	146 to 154	148	148	148	147	148	148
100	96 to 104	97	97	97	96	97	97
50	47 to 53	49	48	47	47	47	47
0	-3 to 3	0			-1	0	0
-50	-53 to -47	-51			-52	-51	-51

Pass/Fail based on +/- 0.75% of Rankine value

Fail indicated by cell highlighting

Reviewed by:





## THERMOCOUPLE CALIBRATION

Meter Out

THERMOCOUPLE ID C14-O

Cal Date: 12/31/2019

CALIBRATION TECHNICIAN: SL1

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

### TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

### DATE

12/12/2019

12/12/2019

### LABORATORY

NBS Calibrations

NBS Calibrations

Temperature Calibration Points	20	70	150
Reference Deg F (To)	20	70	150
Probe Temp (deg F)	21.1	70.2	148.5
Difference (degrees)	1.1	0.2	1.5

TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)	YES	YES	YES
---------------------------------------------------	-----	-----	-----

Reviewed by:

# Meter Pyrometer Calibration

Meter I.D.		C-6				
Temperature	CL-300-100F					
Calibrator Used	CL-3512-A	X	X	X	X	X
DATE		1/3/2020	1/3/2020	1/3/2020	1/3/2020	1/3/2020
TECHNICIAN		RMP	RMP	RMP	RMP	RMP
Thermocouple I.D.		T.C. 1	T.C. 2	T.C. 3	T.C. 4	T.C. 5
Reference °F	Acceptable Range	** If not within Acceptable Range, unit not to be used within range at which failure occurred.				
1950	1932 to 1968	1957				1957
1800	1784 to 1816	1804				1804
1600	1585 to 1615	1600				1605
1400	1387 to 1413	1403				1403
1200	1188 to 1212	1208				1206
1000	990 to 1010	1005				1005
900	890 to 910	904				904
800	791 to 809	804				804
700	692 to 708	704				704
600	593 to 607	601				602
500	493 to 507	499	500	500		500
400	394 to 406	400	400	400		400
300	295 to 305	301	301	301		301
200	196 to 204	201	201	201		201
150	146 to 154	150	150	150	149	149
100	96 to 104	99	99	99	98	99
50	47 to 53	49	49	49	48	49
0	-3 to 3	1			0	1
-50	-53 to -47	-49			-50	-50

Pass/Fail based on +/- 0.75% of Rankine value

Fail indicated by cell highlighting

Reviewd by:





## THERMOCOUPLE CALIBRATION

Meter In THERMOCOUPLE ID C6-I  
Cal Date: 1/4/2020

CALIBRATION TECHNICIAN: SL1

REFERENCE STANDARDS	TRACEABILITY		DATE	LABORATORY
Hart Scientific 9103-A s/n A1B289	Report No. T19-1212-TN-2		12/12/2019	NBS Calibrations
Fluke 9144 s/n B5A077	Report No. T19-1212-TN-3		12/12/2019	NBS Calibrations
Temperature Calibration Points	20	70	150	
Reference Deg F (To)	20	70	150	
Probe Temp (deg F)	20.2	71.5	149.0	
Difference (degrees)	0.2	1.5	1.0	
TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)				
	YES	YES	YES	

Reviewed by:





## THERMOCOUPLE CALIBRATION

Meter Out

THERMOCOUPLE ID

C6-O

Cal Date:

1/4/2020

CALIBRATION TECHNICIAN: SL1

### REFERENCE STANDARDS

### TRACEABILITY

### DATE

### LABORATORY

Hart Scientific 9103-A s/n A1B289

Report No. T19-1212-TN-2

12/12/2019

NBS Calibrations

Fluke 9144 s/n B5A077

Report No. T19-1212-TN-3

12/12/2019

NBS Calibrations

### Temperature Calibration Points

20

70

150

Reference Deg F (To)

20

70

150

Probe Temp (deg F)

21.7

69.9

148.9

Difference (degrees)

1.7

0.1

1.1

TC Meets Method 5 Specifications: ( $\pm 2.0$  °F)

YES

YES

YES

Reviewed by:

Nozzle Calibration  
Indurating Furnace Stack A (SV014)

Nozzle Calibration

Nozzle No. 

Stack A-1
-----------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches

1	0.220
2	0.219
3	0.220
Average	0.220

Test Date 6/23/2020

Date Measured: 6/23/2020

Technician: MJN

Signature:



ArcelorMittal  
Minorca Mine Inc.  
Virginia, Minnesota

Barr Engineering Co.  
July 28, 2020

Nozzle Calibration  
Indurating Furnace Stack B (SV015)

Nozzle Calibration

Nozzle No. 

Stack B-1
-----------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches

1	0.220
2	0.220
3	0.220
Average	0.220

Test Date 6/24/2020

Date Measured: 6/24/2020

Technician: MJN

Signature:



Nozzle Calibration  
Indurating Furnace Stack C (SV016)

Nozzle Calibration

Nozzle No. 

Stack C-1
-----------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches

1	0.214
2	0.216
3	0.215
Average	0.215

Test Date 6/23/2020

Date Measured: 6/23/2020

Technician: MJN

Signature:



ArcelorMittal  
Minorca Mine Inc.  
Virginia, Minnesota

Barr Engineering Co.  
July 28, 2020

Nozzle Calibration  
Indurating Furnace Stack D (SV017)

Nozzle Calibration

Nozzle No. 

Stack D-1
-----------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches

1	0.214
2	0.215
3	0.215
Average	0.215

Test Date 6/24/2020

Date Measured: 6/24/2020

Technician: MJN

Signature:



Method 4 Balance Check  
Indurating Furnace Stacks A & C (SV014 & SV016)

EPA Method 4 Balance Check

Class II Weight Amount =	1000.0
Balance Response=	1000.0
Difference	0.0
Pass	PASS

Test Date 6/23/2020

Date Measured: 6/23/2020

Technician: MJN

Signature:



ArcelorMittal  
Minorca Mine Inc.  
Virginia, Minnesota

Barr Engineering Co.  
July 28, 2020

Method 4 Balance Check  
Indurating Furnace Stacks B & D (SV015 & SV017)

EPA Method 4 Balance Check

Class II Weight Amount =	1000.0
Balance Response=	1000.0
Difference	0.0
Pass	PASS

Test Date 6/24/2020

Date Measured: 6/24/2020

Technician: MJN

Signature:





## S-Type Pitot Tube Geometry Check

Pitot Tube

Number:

5-6

Length:

5ft

Function:

M-5 Probe Free

Inspection Date:

1-6-20

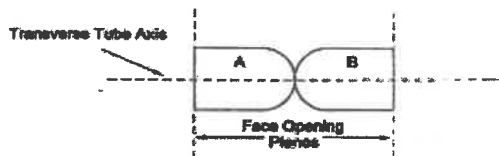
Technician:

DAH

1. Are face openings perpendicular to tube axis?

☒ YES (go to 2)

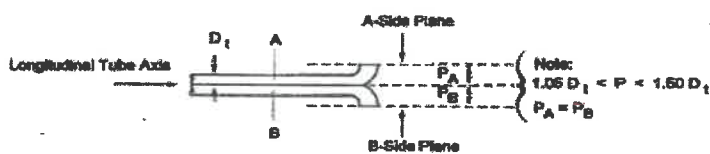
☐ NO (go to 1a)



2. Are face openings parallel to longitudinal axis?

☒ YES (go to 3)

☐ NO (go to 2a)



1a. If NO, is angle less than 10°?

☐ YES (go to 2)

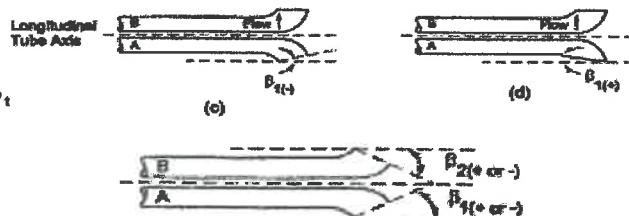
☐ NO (discontinue use)



2a. If NO, is angle less than 5°?

☐ YES (go to 3)

☐ NO (discontinue use)



3. Are legs of equal length?

☒ YES (go to 4)

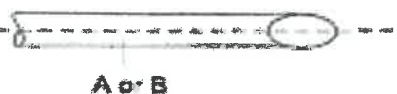
☐ NO (go to 3a)



4. Are center-lines of legs coincident?

☒ YES (go to 5)

☐ NO (go to 4a)



3a. If NO, is difference less than 1/8 inch?

☐ YES (go to 4)

☐ NO (discontinue use)



4a. If NO, are center-lines of face openings less than 1/32 inch?

☐ YES (go to 5)

☐ NO (discontinue use)



5. Does this pitot tube pass all of the above criteria?

☒ YES

☐ NO

I certify that the pitot tube meets or exceeds all specifications and criteria listed in 40 CFR Part 60, Appendix A, EPA Method 2, and is assigned a pitot tube certification factor of 0.84.

Technician Signature:

*DAH*

Reviewed by:

*[Signature]*





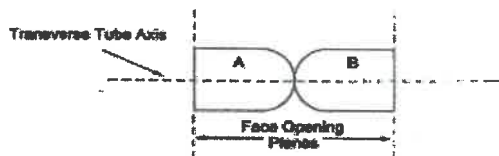
## S-Type Pitot Tube Geometry Check

Pitot Tube  
Number: 6-4  
Length: 6 ft  
Function: M-5 Probe / Free

Inspection Date: 1-3-20  
Technician: DAH

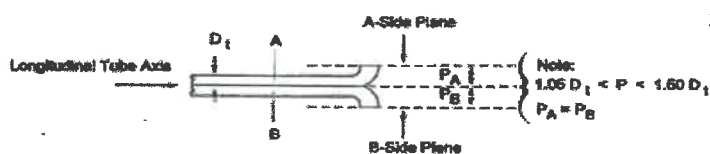
1. Are face openings perpendicular to tube axis?

☒ YES (go to 2) ☐ NO (go to 1a)



2. Are face openings parallel to longitudinal axis?

☒ YES (go to 3) ☐ NO (go to 2a)



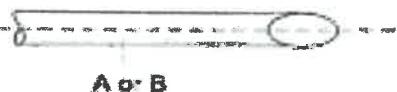
3. Are legs of equal length?

☒ YES (go to 4) ☐ NO (go to 3a)



4. Are center-lines of legs coincident?

☒ YES (go to 5) ☐ NO (go to 4a)



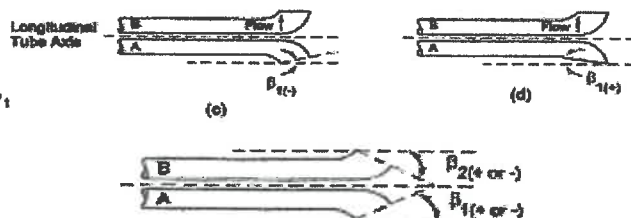
1a. If NO, is angle less than 10°?

☐ YES (go to 2) ☐ NO (discontinue use)



2a. If NO, is angle less than 5°?

☐ YES (go to 3) ☐ NO (discontinue use)



3a. If NO, is difference less than 1/8 inch?

☐ YES (go to 4) ☐ NO (discontinue use)



4a. If NO, are center-lines of face openings less than 1/32 inch?

☐ YES (go to 5) ☐ NO (discontinue use)



5. Does this pitot tube pass all of the above criteria?

☒ YES ☐ NO

I certify that the pitot tube meets or exceeds all specifications and criteria listed in 40 CFR Part 60, Appendix A, EPA Method 2, and is assigned a pitot tube certification factor of 0.84.

Technician Signature: DAH

Reviewed by:



# THERMOCOUPLE CALIBRATION

THERMOCOUPLE ID 5-6

Cal Date: 12/30/2019

Method 5 Probe

CALIBRATION TECHNICIAN: SL1

## REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

## TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

## DATE

12/12/2019

12/12/2019

## LABORATORY

NBS Calibrations

NBS Calibrations

## Temperature Calibration Points

32

212

400

650

Ambient

Reference Deg F (To)

32

212

400

650

70

Probe Temp (deg F)

33.3

211

396

647

70.7

Reference Temp (deg R) deg F + 460

492

672

860

1110

530

Probe Temp (deg R), deg F + 460

493.3

671

856

1107

530.7

Difference (degrees)

-1.3

1

4

3

-0.7

% Diff Abs. T

0.3%

0.1%

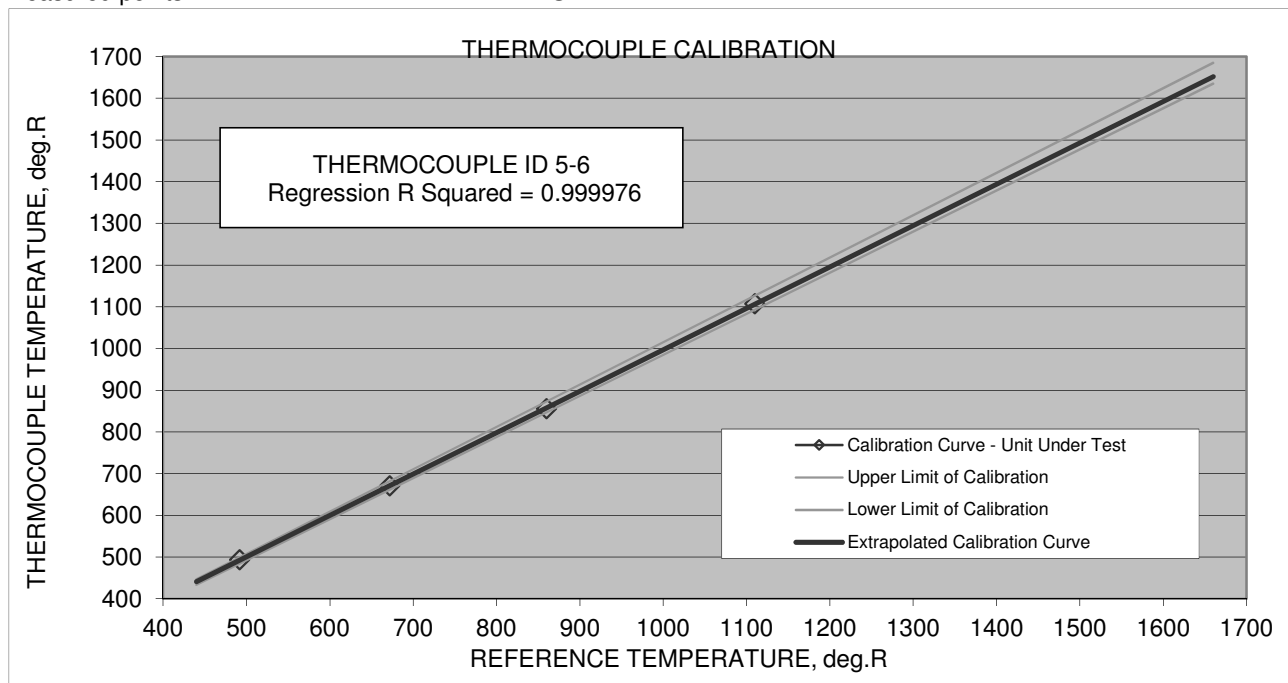
0.5%

0.3%

0.1%

Is difference less than 1.5% at all  
measured points?

YES



Are extrapolated limits less than 1.5%?

YES

FAHRENHEIT  
CALIBRATION RANGE  
-20 1200

If not acceptable, describe corrective action:

Reviewed by:



# THERMOCOUPLE CALIBRATION

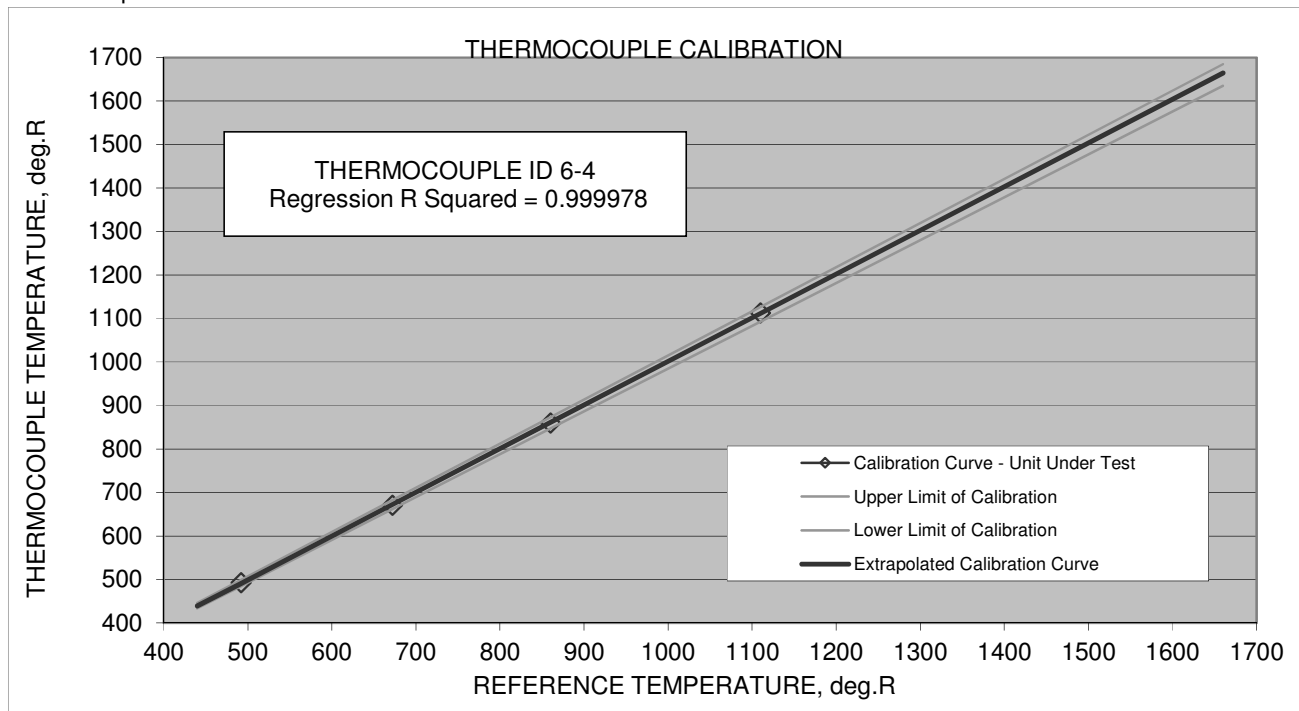
THERMOCOUPLE ID 6-4

Cal Date: 12/31/2019

Method 5 Probe

CALIBRATION TECHNICIAN: SL1

REFERENCE STANDARDS	TRACEABILITY		DATE	LABORATORY	
Hart Scientific 9103-A s/n A1B289	Report No. T19-1212-TN-2		12/12/2019	NBS Calibrations	
Fluke 9144 s/n B5A077	Report No. T19-1212-TN-3		12/12/2019	NBS Calibrations	
Temperature Calibration Points	32	212	400	650	Ambient
Reference Deg F (To)	32	212	400	650	70
Probe Temp (deg F)	32.6	211	400	653	70.1
Reference Temp (deg R) deg F + 460	492	672	860	1110	530
Probe Temp (deg R), deg F + 460	492.6	671	860	1113	530.1
Difference (degrees)	-0.6	1	0	-3	-0.1
% Diff Abs. T	0.1%	0.1%	0.0%	0.3%	0.0%
Is difference less than 1.5% at all measured points?	YES				



Are extrapolated limits less than 1.5%? YES

FAHRENHEIT  
CALIBRATION RANGE  
-20 1200

If not acceptable, describe corrective action:

Reviewed by:



## THERMOCOUPLE CALIBRATION

Impinger Outlet

THERMOCOUPLE ID TIO-8948

Cal Date: 3/4/2020

CALIBRATION TECHNICIAN: SL1

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

### TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

### DATE

12/12/2019

12/12/2019

### LABORATORY

NBS Calibrations

NBS Calibrations

Temperature Calibration Points	20	70	150
Reference Deg F (To)	20	70	150
Probe Temp (deg F)	20.6	70.0	149.7
Difference (degrees)	0.6	0.0	0.3
TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)	YES	YES	YES

Reviewed by: *David Herbst*



## THERMOCOUPLE CALIBRATION

Impinger Outlet

THERMOCOUPLE ID TIO-6268

Cal Date: 1/4/2020

Umbilical 200-2

CALIBRATION TECHNICIAN: SL1

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

### TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

### DATE

12/12/2019

12/12/2019

### LABORATORY

NBS Calibrations

NBS Calibrations

### Temperature Calibration Points

20

70

150

Reference Deg F (To)

20

70

150

Probe Temp (deg F)

21.1

70.0

148.7

Difference (degrees)

1.1

0.0

1.3

TC Meets Method 5 Specifications: ( $\pm 2.0$  °F)

YES

YES

YES

Reviewed by:



### Field Barometer Calibration

Calibration to National Weather Service at Chisholm-Hibbing Airport

Station elevation at Barr Hibbing Office 3128 14th Avenue East, Hibbing, MN 1460 ft.

Date	Technician	NWS Observation		Field Barometer			Barr Office	Condition	Remarks	Offset
		Time	Altimeter	ID	Time	Barometric Pressure	Station Pressure			
5/26/20	DJK	8:53	29.85	BA-16	9:20	28.42	28.39	In Calibration	As Found	0.03
7/7/20	DJK	8:53	29.99	BA-16	9:33	28.55	28.53	In Calibration	As Found	0.02



Assay Laboratory: Red Ball TGS  
555 Craig Kennedy Way  
Shreveport, LA 71107  
800-551-8150

## CERTIFICATE OF ANALYSIS (Zero Ambient Nitrogen)

Cylinder Number: EB0098633  
Product ID Number: 121026  
Cylinder Pressure: 1900 PSIG  
COA #: EB0098633.20181116-0  
Customer PO. NO.:  
Customer:

Certification Date: 11/16/2018  
Expiration Date: 11/14/2026  
MFG Facility: RBTGS-Shreveport-LA  
Lot Number: EB0098633.20181116  
Tracking Number: B1945239  
Previous Certification Dates:

This mixture is for laboratory use only, not for drug, household or other use.  
This mixture is certified in Mole % to be within  $\pm 2\%$  of the actual number reported with a confidence of 95%.  
This mixture was manufactured by scale; weights traceable to N.I.S.T. Certificate #822/266926-02.  
Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Composing Material: Zero Ambient Nitrogen, Cert., Sz152

Component	Specification	Concentration
Nitrogen	Balance	Balance
Oxygen as Impurity	<1.0 PPM	<1.0 PPM
Carbon Dioxide as Impurity	<0.5 PPM	<0.5 PPM
Carbon Monoxide as Impurity	<0.5 PPM	<0.5 PPM
Total Oxides of Nitrogen as Impurity	<0.1 PPM	<0.1 PPM
Sulfur Dioxide as Impurity	<0.1 PPM	<0.1 PPM
Total Hydrocarbons as Impurity	<0.1 PPM	<0.1 PPM

Red Ball Technical Gas Service  
PGVP Vendor ID # G12018  
Information and Ordering  
800-551-8150  
Fax (318-425-6309)



*B. Theus*

Brandon Theus  
Laboratory Supervisor

Version 02-B, Revised on 2015-05-27



Red Ball Technical Gas Service  
555 Craig Kennedy Way  
Shreveport, LA 71107  
800-551-8150  
PGVP Vendor ID # G12018

## EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number: EB0098397  
Product ID Number: 127199  
Cylinder Pressure: 1900 PSIG  
COA #: EB0098397.20180416-0  
Customer PO. NO.:  
Customer:

Certification Date: 04/27/2018  
Expiration Date: 04/25/2026  
MFG Facility: - Shreveport - LA  
Lot Number: EB0098397.20180416  
Tracking Number: B1944966  
Previous Certification Dates:

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

### Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Carbon Dioxide	4.89 %	±0.05 %	NDIR	04/27/2018
Oxygen	22.5 %	±0.12 %	MPA	04/20/2018

Nitrogen

Balance

Analytical Measurement Data Available Online.

### Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
EB0019964	EB0019964.20170209	08/05/2025	GMIS	N2	O2	24 %	0.502	071001
EB0072967	EB0072967.20170424	11/25/2025	GMIS	N2	CO2	9.52 %	0.753	C1309410.01

### Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
O2	MPA	Thermo	410i	1162980025	04/19/2018
CO2	NDIR	Thermo	410i	1162980025	04/27/2018

### SMART-CERT



This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

*LaMeka Dennis*

LaMeka Dennis  
Laboratory Operations Manager  
Assay Laboratory: Red Ball TGS  
Version 02-1, Revised on 2017-09-07





Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Praxair (213) 585-2154  
Praxair (84) 542-6689

## Report Of Analysis EPA Protocol Gas Mixtures

BARR01  
TO: Barr Engineering Co  
Attn: Benjamin Wiltse  
5150 West 76th Street  
Edina, MN 55439-2900  
(952) 832-2885

REPORT NO: 92419467  
REPORT DATE: June 29, 2017  
CUSTOMER PO NO: BAW05172017

CYLINDER NUMBER: CC106732

CYLINDER SIZE: 150A (141 std cu ft)  
CYLINDER PRESSURE: 2000 psig

COMPONENT	MOLAR CONCENTRATION ± EXPANDED UNCERTAINTY	REFERENCE STANDARD	ANALYZER MAKE, MODEL, S/N, DETECTION	REPLICATE ANALYSIS DATA
Carbon dioxide	9.50 ± 0.06 %	GMIS	SRM 1674b	6/28/2017
			Samp#: 7-H-39	9.49 %
		Cyl#: CC116770	Cyl#: FF10598	9.51 %
		7.99 ± 0.08 %	6.944 ± 0.013 %	9.50 %
		Exp: 3/18/2022	Exp: 6/17/2019	LAST CAL DATE: 6/28/2017 $\bar{x}$ : 9.50 %
Oxygen	9.48 ± 0.04 %	GMIS	SRM 2658a	6/23/2017
			Samp#: 72-D-37	9.45 %
		Cyl#: CA03042	Cyl#: CAL016820	9.48 %
		10.17 ± 0.02 %	9.918 ± 0.022 %	9.50 %
		Exp: 1/11/2024	Exp: 6/1/2017	LAST CAL DATE: 6/7/2017 $\bar{x}$ : 9.48 %
Nitrogen	Balance			

CERTIFICATION DATE: June 23, 2017

EPA EXPIRATION DATE: June 24, 2025

ppm =  $\mu$ mole/mole

% = mole-%

$\bar{x}$  = EPA weighted mean

The above analyses were performed in accordance with Procedure G1 of the EPA Traceability Protocol, Report Number EPA600/R-12/531, dated May 2012.

The above analyses should not be used if the cylinder pressure is less than 100 psig.

ANALYST: 

M.S. Calhoun

APPROVED: 

M. Dodd

The only liability of this company for gas which fails to comply with this analysis shall be replacement or reanalysis thereof by the company without extra cost.

*Making Our Planet More Productive*

## Appendix E

### Process Operating Data

# Air Performance Test Form

## Operating Data Summary for Process Sources

### Facility Information (please print)

Company Name: ArcelorMittal  
Test date(s): 06/23/20

Equipment ID No: SV014

### Equipment and Operating Data

- Process Equipment Description: Indurating Furnace Stack A
- Were the process and control equipment operated consistent with normal procedures? ☒ Yes ☐ No If no, explain: \_\_\_\_\_
- Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, pounds per hour, pressure, air flow, etc.
- Date(s) and procedure(s) of last maintenance/cleaning within 6 months:  
☒ Remains unchanged from info. provided in test plan
- Process rate (amount of raw material or finished product per hour, wet or dry basis) while combusting (list fuel type(s) and ratios as appropriate) \_\_\_\_\_

Process Parameter: list type and units	Run 1	Run 2	Run 3	Run 4	Average
Finished Pellet Production Rate (LTPH)	364	363	364		364
Fuel Input (list units)					
Heat Input (10 <sup>6</sup> British thermal units/hour)					

- Summarize control equipment operating data documented during testing. Values reported should reflect maximum, minimum, averages, or as approved in the test plan. (See test plan and approval letter)

### Examples of APC equipment and parameters generally monitored. Monitor as in test plan and/or approval letter.

- Scrubber (list type of scrubber): DP (in. w.c.) and feed rate (gpm and psig)
- Baghouse, Cyclone, and Multi-clone: DP (in. w.c.)
- Catalytic Incinerator : (°F<sub>in</sub> , °F<sub>out</sub>) and Thermal Incinerator: (°F<sub>temperature</sub>)
- ESP: Number and identity of operating field(s)

APC and parameter monitored	Run 1	Run 2	Run 3	Run 4	Average
List pollutant & averaging basis.--should reflect permit	Run 1	Run 2	Run 3	Run 4	Average
Continuous Opacity Monitor(list hourly average)					
Monitor (list averaging basis):					
Monitor (list averaging basis):					

Abbreviations: APC=air pollution control      gpm.=gallons per minute      in. w.c.=inches of water column  
lbs.-pounds      psig=pressure per square inch gauge      ΔP=pressure drop

**Note:** This form provides only a summary of the operating conditions during the performance test. Additional and more detailed records are required to meet the requirements of Minn. R. 7017.2035, subp. 3. This form is to be submitted as part of the performance test report

# Air Performance Test Form

## Operating Data Summary for Process Sources

### Facility Information (please print)

Company Name: ArcelorMittal  
Test date(s): 06/24/20

Equipment ID No: SV015

### Equipment and Operating Data

- Process Equipment Description: Indurating Furnace Stack B
- Were the process and control equipment operated consistent with normal procedures? ☒ Yes ☐ No If no, explain: \_\_\_\_\_
- Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, pounds per hour, pressure, air flow, etc.
- Date(s) and procedure(s) of last maintenance/cleaning within 6 months:  
☒ Remains unchanged from info. provided in test plan
- Process rate (amount of raw material or finished product per hour, wet or dry basis) while combusting (list fuel type(s) and ratios as appropriate \_\_\_\_\_)

Process Parameter: list type and units	Run 1	Run 2	Run 3	Run 4	Average
Finished Pellet Production Rate (LTPH)	363	362	359		361
Fuel Input (list units)					
Heat Input (10 <sup>6</sup> British thermal units/hour)					

- Summarize control equipment operating data documented during testing. Values reported should reflect maximum, minimum, averages, or as approved in the test plan. (See test plan and approval letter)

### Examples of APC equipment and parameters generally monitored. Monitor as in test plan and/or approval letter.

- Scrubber (list type of scrubber): DP (in. w.c.) and feed rate (gpm and psig)
- Baghouse, Cyclone, and Multi-clone: DP (in. w.c.)
- Catalytic Incinerator: (°F<sub>in</sub>, °F<sub>out</sub>) and Thermal Incinerator: (°F<sub>temperature</sub>)
- ESP: Number and identity of operating field(s)

APC and parameter monitored	Run 1	Run 2	Run 3	Run 4	Average
List pollutant & averaging basis.--should reflect permit	Run 1	Run 2	Run 3	Run 4	Average
Continuous Opacity Monitor(list hourly average)					
Monitor (list averaging basis):					
Monitor (list averaging basis):					

Abbreviations: APC=air pollution control      gpm.=gallons per minute      in. w.c.=inches of water column  
lbs.-pounds      psig=pressure per square inch gauge      ΔP-=pressure drop

**Note:** This form provides only a summary of the operating conditions during the performance test. Additional and more detailed records are required to meet the requirements of Minn. R. 7017.2035, subp. 3. This form is to be submitted as part of the performance test report

# Air Performance Test Form

## Operating Data Summary for Process Sources

### Facility Information (please print)

Company Name: ArcelorMittal  
Test date(s): 06/23/20

Equipment ID No: SV016

### Equipment and Operating Data

- Process Equipment Description: Indurating Furnace Stack C
- Were the process and control equipment operated consistent with normal procedures? YES ☒ No ☐ If no, explain: \_\_\_\_\_
- Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, pounds per hour, pressure, air flow, etc.
- Date(s) and procedure(s) of last maintenance/cleaning within 6 months:  
☒ Remains unchanged from info. provided in test plan
- Process rate (amount of raw material or finished product per hour, wet or dry basis) while combusting (list fuel type(s) and ratios as appropriate) \_\_\_\_\_

Process Parameter: list type and units	Run 1	Run 2	Run 3	Run 4	Average
Finished Pellet Production Rate (LTPH)	364	363	364		364
Fuel Input (list units)					
Heat Input (10 <sup>6</sup> British thermal units/hour)					

- Summarize control equipment operating data documented during testing. Values reported should reflect maximum, minimum, averages, or as approved in the test plan. (See test plan and approval letter)

### Examples of APC equipment and parameters generally monitored. Monitor as in test plan and/or approval letter.

- Scrubber (list type of scrubber): DP (in. w.c.) and feed rate (gpm and psig)
- Baghouse, Cyclone, and Multi-clone: DP (in. w.c.)
- Catalytic Incinerator : (°F<sub>in</sub>, °F<sub>out</sub>) and Thermal Incinerator: (°F<sub>temperature</sub>)
- ESP: Number and identity of operating field(s)

APC and parameter monitored	Run 1	Run 2	Run 3	Run 4	Average
List pollutant & averaging basis.--should reflect permit	Run 1	Run 2	Run 3	Run 4	Average
Continuous Opacity Monitor(list hourly average)					
Monitor (list averaging basis):					
Monitor (list averaging basis):					

Abbreviations: APC=air pollution control      gpm.=gallons per minute      in. w.c.=inches of water column  
lbs.-pounds      psig=pressure per square inch gauge      ΔP-=pressure drop

**Note:** This form provides only a summary of the operating conditions during the performance test. Additional and more detailed records are required to meet the requirements of Minn. R. 7017.2035, subp. 3. This form is to be submitted as part of the performance test report

**Facility Information (please print)**

Company Name: ArcelorMittal

Test date(s): 06/24/20

Equipment ID No: SV017

1. Process Equipment Description: Indurating Furnace Stack D

2. Were the process and control equipment operated consistent with normal procedures? ☒ Yes ☐ No If no, explain:

3. Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, pounds per hour, pressure, air flow, etc.

4. Date(s) and procedure(s) of last maintenance/cleaning within 6 months:

X	Remains unchanged from info. provided in test plan
---	----------------------------------------------------

5. Process rate (amount of raw material or finished product per hour, wet or dry basis) while combusting (list fuel type(s) and ratios as appropriate)

Process Parameter: list type and units	Run 1	Run 2	Run 3	Run 4	Average
Finished Pellet Production Rate (LTPH)	363	362	359		361
Fuel Input (list units)					
Heat Input (10 <sup>6</sup> British thermal units/hour)					

6. Summarize control equipment operating data documented during testing. Values reported should reflect maximum, minimum, averages, or as approved in the test plan. (See test plan and approval letter)

**Examples of APC equipment and parameters generally monitored. Monitor as in test plan and/or approval letter.**

· **Scrubber** (list type of scrubber): DP (in. w.c.) and feed rate (gpm and psig)

· **Baghouse, Cyclone, and Multi-clone:** DP (in. w.c.)

· **Catalytic Incinerator** : ( $^{\circ}\text{F}_{\text{in}}$ ,  $^{\circ}\text{F}_{\text{out}}$ ) and **Thermal Incinerator**: ( $^{\circ}\text{F}_{\text{temperature}}$ )

- **ESP:** Number and identity of operating field(s)

APC and parameter monitored	Run 1	Run 2	Run 3	Run 4	Average
List pollutant & averaging basis.--should reflect permit	Run 1	Run 2	Run 3	Run 4	Average
Continuous Opacity Monitor(list hourly average)					
Monitor (list averaging basis):					
Monitor (list averaging basis):					

**Abbreviations:** APC=air pollution control  
lbs.-pounds

**gpm.=gallons per minute**  
**psig=pressure per square inch gauge**

in. w.c.=inches of water column  
 $\Delta P$ -=pressure drop

**Note:** This form provides only a summary of the operating conditions during the performance test. Additional and more detailed records are required to meet the requirements of Minn. R. 7017.2035, subp. 3. This form is to be submitted as part of the performance test report

ArcelorMittal  
 Minorca Mine Inc.  
 Virginia, Minnesota

Finished Pellet Production Rate  
 Hg testing June 23-24, 2020  
 Indurating Furnace Line (EU026)  
 Stacks A-D (SV014-SV017)

Barr Engineering Co.  
 7/29/2020

Finished Pellet Production

A110CV02CNVYR_SCALE_LS		
timestamp	THR_VAL0	Column1
6/23/2020 8:00	364	Run 1
6/23/2020 9:00	365	Run 1
6/23/2020 10:00	363	Run 1/Run 2
6/23/2020 11:00	363	Run 1/Run 2
6/23/2020 12:00	363	Run 2
6/23/2020 13:00	364	Run 2/Run 3
6/23/2020 14:00	363	Run 3
6/23/2020 15:00	366	Run 3
6/23/2020 16:00	364	Run 3
6/23/2020 17:00	359	
6/23/2020 18:00	353	
6/23/2020 19:00	358	
6/23/2020 20:00	362	
6/23/2020 21:00	379	
6/23/2020 22:00	363	
6/23/2020 23:00	361	
6/24/2020 0:00	373	
6/24/2020 1:00	368	
6/24/2020 2:00	370	
6/24/2020 3:00	364	
6/24/2020 4:00	377	
6/24/2020 5:00	379	
6/24/2020 6:00	358	
6/24/2020 7:00	363	
6/24/2020 8:00	362	Run 1
6/24/2020 9:00	360	Run 1
6/24/2020 10:00	366	Run 1/Run 2
6/24/2020 11:00	362	Run 1/Run 2
6/24/2020 12:00	364	Run 2
6/24/2020 13:00	354	Run 2/Run 3
6/24/2020 14:00	355	Run 3
6/24/2020 15:00	368	Run 3

Furnace Stacks A & C

Run	Start Time	End Time	Average
Run 1	8:08am	10:15am	364
Run 2	10:35am	12:42pm	363
Run 3	1:11pm	3:19pm	364
<b>3-Run Average</b>			<b>364</b>

Furnace Stacks B & D

Run	Start Time	End Time	Average
Run 1	8:10am	10:16am	363
Run 2	10:40am	12:45pm	362
Run 3	1:00pm	3:06pm	359
<b>3-Run Average</b>			<b>361</b>

## Appendix F

### Stack Test Plan



## Michael J. Norstrem

---

**From:** Place, Andrew (MPCA) <andrew.place@state.mn.us>  
**Sent:** Monday, June 15, 2020 12:05 PM  
**To:** Johnson, Jaime (Jaime.Johnson@arcelormittal.com)  
**Cc:** Palzkill, Steven (MPCA); Michael J. Norstrem  
**Subject:** Test Plan Approval: Indurating Machine Mercury

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

**Include a copy of the Test Plan and this Test Plan Approval Email in the Final Report**

### Test Plan Approval Letter

Facility: ArcelorMittal Minorca Mine Inc.  
Address: 5950 Old Highway 53, PO Box 1, Virginia, MN 55792  
Contact Person/Phone: Jaime Johnson, Environmental Manager  
Test Date: June 23, 2020  
Test Plan Submittal Date: May 7, 2020  
Pretest Meeting Date: via email  
Units to be Tested: Indurating Furnace (EQUI 38/EU026; STRU 1 – 4/SV014 – 016 ; TREA 15 – 18/CE014 – 017) Mercury required by Minn. R. 7019.3050  
Agency Interest ID: 699

**Your test plan has been approved by the Minnesota Pollution Control Agency (MPCA) as follows:**

1. Test will be conducted using Ontario Hydro method.
2. Furnace will be operated at greater than 340 long tons finished pellets/hour as stated in test plan.
3. Include in the final test report all process and pollution control equipment operating data collected at 15 minute intervals (minimum) and averaged for each test run and test. This information must be clear easily understood by individuals not familiar with the process. All information needed to show process operating rate and pollution control equipment compliant operation must be included. A link to reporting forms can be found below.
3. An acceptable report must comply with Minn. Rule 7017.2035 PERFORMANCE TEST REPORTING REQUIREMENTS. Use of the PTRCC form will help assure that a complete test report is submitted to the MPCA.

**In the event of a failure:**

**Please be aware that enforcement action will be taken for performance test failures, indicating emissions above applicable limits, which can include a monetary penalty. Upon discovery of the test failure, the Regulated Party must take immediate action to reduce emissions to remain in compliance with its permitted limits. The actions taken should be documented, as they will become part of the record of corrective actions. If a monetary penalty is required, the amount of time from the date of the failed test to the date of the passed test, or other compliance demonstration, will be taken into consideration. It is in the Regulated Party's best interest to demonstrate compliance with its permitted emissions limits through a passed retest or other compliance demonstration as soon as possible after a failed test.**

**All periods of noncompliance with emission limits must be reported to the MPCA, this includes any periods of engineering tests. The requirements outlined under the Notification of Deviations Endangering Human Health or the Environment, Minn. R. 7019.1000, subp. 1., shall be followed. This information should also be clearly stated and readily available in the executive summary of the test report.**

Andy Place  
State Program Administrator Principal  
Minnesota Pollution Control Agency  
520 Lafayette Road No.  
St. Paul, Minnesota 55155-4194  
651-757-2652  
[andrew.place@state.mn.us](mailto:andrew.place@state.mn.us)

The following forms are available at <http://www.pca.state.mn.us/jsrid16>  
Operating Data Summary – Combustion Sources  
Operating Data Summary – Process Sources  
Operating Data Summary – Asphalt Plants  
Report Certifications Form  
Performance Test Report Completeness Criteria (PTRCC)

**(Preferred)** Electronic copies of the test report submitted to [SubmitStackTest.PCA@state.mn.us](mailto:SubmitStackTest.PCA@state.mn.us)  
**If an electronic copy of the complete test report is submitted the paper and CD copies are not required. Please follow requirements outlined in Method 1 of the document found at this link:**  
**<https://www.pca.state.mn.us/sites/default/files/aq1-39.pdf>**

Hard Copy Performance Test Reports and Microfiche or CD Copy submittals will be addressed to:  
Air Quality Compliance Tracking Coordinator  
Industrial Division  
Minnesota Pollution Control Agency  
520 Lafayette Road North  
St. Paul, Minnesota 55155-4194

NOTICE: This email (including attachments) is covered by the Electronic Communications Privacy Act, 18 U.S.C. 2510-2521. This email may be confidential and may be legally privileged. If you are not the intended recipient, you are hereby notified that any retention, dissemination, distribution, or copying of this communication is strictly prohibited. Please reply back to the sender that you have received this message in error, then delete it. Thank you

## Michael J. Norstrem

---

**From:** Johnson, Jaime <Jaime.Johnson@arcelormittal.com>  
**Sent:** Tuesday, May 12, 2020 7:54 AM  
**To:** Place, Andrew (MPCA); Michael J. Norstrem  
**Cc:** Johnson, Jaime; Zavoda, Rich  
**Subject:** ArcelorMittal Stack Test Plan - June 2020  
**Attachments:** ArcelorMittal Test Plan June 2020 Mercury Testing.pdf

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Andy,

Please find attached the Test Plan for ArcelorMittal Minorca Mine. Mercury testing will be performed on the pellet indurating furnace stacks the week of 22nd June 2020. Testing is performed to satisfy Minnesota Mercury Rule - Minn.Rule 7019.3050 (E)(5). If you have any questions please do not hesitate to contact me. I would propose to have a pre-test conference call the week of 15th June 2020 if you have availability. Please indicate a date and time which works for you and I will set a meeting notice.

Cheers,  
Jaime

**Jaime L. Johnson**  
Manager - Environmental

**ArcelorMittal Minorca Mine Inc.**  
5950 Old U.S. Highway 53 | Virginia, MN 55792  
T +1 218 305 3337 | F +1 218 749 5256  
[www.arcelormittal.com](http://www.arcelormittal.com)

*"Wrinkles only go where the smiles have been" – Jimmy Buffett*

*"Happiness cannot be traveled to, owned, earned, worn, or consumed. Happiness is a spiritual experience of living every minute with love, grace, and gratitude" - Dennis Waitley*

*"I believe that imagination is stronger than knowledge - myth is more potent than history - dreams are more powerful than facts - hopes always triumphs over experience - laughter is the cure for grief - love is stronger than death" - Robert Fulghum*

**NOTICE:** The information contained in this electronic mail transmission is for the use of the individual or entity to which it is addressed or intended and may contain information that is privileged, personal or otherwise confidential. It is not intended for transmission to, or receipt by, any individual or entity other than the named or intended addressee (or a person authorized to deliver it to the named or intended addressee) except as otherwise expressly permitted in this electronic mail transmission. If you have received this electronic transmission in error, please delete it without copying or forwarding it, and notify the sender of the error. Although the sender takes measures to protect its network against viruses, no assurance is given that this transmission is virus-free. Thank you!

## TEST PLAN FOR A TACONITE PROCESSING FACILITY

ARCELORMITTAL MINORCA MINE INC  
VIRGINIA, MINNESOTA

Date test plan created/revised: May 7, 2020

Scheduled test date(s): June 23-24, 2020

### PART I. GENERAL INFORMATION

Name and address of emission facility: ArcelorMittal Minorca Mine Inc.  
5950 Old US Hwy 53  
Virginia, Minnesota 55729

Facility contact information: Jaime Johnson  
(218) 305-3337 (phone)  
(218) 749-5256 (fax)  
email: [Jaime.Johnson@arcelormittal.com](mailto:Jaime.Johnson@arcelormittal.com)

MPCA AQD File Number: 257  
Air Emission Permit Number: 13700062-003  
Agency Interest ID Number: 699

Testing Company and Contact: Barr Engineering Company  
Mike Norstrem  
(218) 262-8672 (phone)  
(218) 262-3460 (fax)  
email: MNorstrem@barr.com

#### Reason the Emission Unit(s) to be Tested:

Mercury testing will be performed on the pellet indurating furnace line stacks A-D (SV014-SV017; EU026). Testing will be performed to satisfy Minnesota Mercury rule - Minn. Rule 7019.3050(E)(5).

Diagrams of the sampling locations, giving all relevant dimensions, will be provided in the performance test report or upon request.

## PART II. TESTING REQUIREMENTS

The table below provides a summary of the pollutants to be tested and test methods.

Stack/Vent # and Source Description	Pollutant Tested and Applicable Emission Limit <sup>1</sup>	Basis of Pollutant Tested	Specific Methods/Procedures Required Citation
Indurating Furnace Line (EU026) Stacks A-D (SV014-SV017)	Hg No applicable limit	MN Mercury Rule Minn. R. 7019.3050	EPA Method 29 for Hg OR ASTM-D6784 (Ontario Hydro) Three 2-hour runs per stack (minimum)

## PART III. OPERATING CONDITIONS

The table below includes a summary of the industrial processes.

Process Parameters to be Monitored		
Process Parameter	Rate/Units	Frequency
Production rate (finished pellet)	≥340 LTPH	Hourly

#### PART IV. TEST METHODS

All tests will be performed using the following USEPA reference test methods with the exception of ASTM-D6784 (Ontario Hydro Method for Hg).

Test Method	
Method 1	Sample and Velocity Traverses for Stationary Sources (once).
Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate. One determination concurrent with each Hg test run.
Method 3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources. A sample will be collected in a tedlar bag during each test run and analyzed after each run.
Method 4	Determination of Moisture Content in Stack Gas. Concurrent with Hg emissions tests.
ASTM-D6784	Standard Test Method for Elemental, Oxidized, Particle-Bound and Total Mercury in Flue Gas Generated from Coal-Fired Stationary Sources (Ontario Hydro Method). Three two-hour test runs will be completed on each source.

#### PART V. Continuous Emissions Monitors

There are no Continuous Emissions Monitors that are germane to this testing.

#### Part VI. Other

##### Testing schedule:

Testing schedule: **Week of June 22, 2020**

Date	Description
Monday June 22, 2020	Travel, Setup
Tuesday	Test Furnace Stacks A & C Simultaneously (SV014, SV016)
Wednesday	Test Furnace Stacks B & D Simultaneously (SV015, SV017)
Thursday	Contingency Day

Note: Scheduled testing order may change depending on process operating schedule.

Jaime Johnson of ArcelorMittal Minorca Mine Inc. will communicate with the MPCA and Barr Engineering Co. to schedule a pretest meeting closer to the test date, but at least 7-days prior to testing.

**Maintenance:** A description of any necessary work done within 30 days prior to the test outside the normal maintenance schedule will be included in the test report

**Test Report:** A copy of the report will be submitted within 45-days after the completion of the last test. The facility does not intend to submit a bound paper copy, but will use the acceptable alternative of submitting a full pdf copy via email to [submitstacktest.pca@state.mn.us](mailto:submitstacktest.pca@state.mn.us). The submittal of the pdf document will also satisfy the microfiche or compact disc submittal requirement under Minn. R. 7017.1080 subp. 3 and Minn. R. 7017.2035 subp. 2, as well as satisfying the 105 day deadline.

**Test Plans and Performance Report Submittals will be addressed to:**

Andy Place  
State Program Administrator Principal  
Minnesota Pollution Control Agency  
520 Lafayette Road  
St. Paul, Minnesota 55155  
(651) 757-2652

**Closing Remarks**

If there are questions or comments about the information provided, please contact me by telephone or e-mail.

Jaime Johnson  
Environmental Manager  
ArcelorMittal Minorca Mine Inc.  
(218) 305-3337  
Jaime.Johnson@arcelormittal.com

## **Appendix G**

### **Project Participants and Contact Information**



## Project Participants

---

### Minnesota Pollution Control Agency

Andy Place – State Program Administrator Principal

### ArcelorMittal Minorca Mine Inc.

Jaime Johnson – Manager - Environmental

### Barr Engineering Co.

Tim Russell – Vice President/Chemical Engineer

Tom Kuchinski – Stack Testing Services Coordinator

Michael J. Norstrem – Air Quality Engineer/Project Manager

Dan Koschak – Senior Air Quality Technician

Ben Wiltse - Senior Air Quality Technician

John A. Rooney – Air Quality Technician

### CONTACT INFORMATION

<b>MPCA</b>	<b>ArcelorMittal Minorca Mine Inc.</b>	<b>Barr Engineering Co.</b>
Andy Place State Program Administrator Principal Minnesota Pollution Control Agency 520 Lafayette Rd. N. Saint Paul, Minnesota 55155 (651) 757-2295 <a href="mailto:Andrew.Place@state.mn.us">Andrew.Place@state.mn.us</a>	Jaime Johnson Manager - Environmental ArcelorMittal Minorca Mine Inc. 5950 Old U.S. Highway 53 Virginia, MN 55792 (218) 305-3337 <a href="mailto:Jaime.Johnson@arcelormittal.com">Jaime.Johnson@arcelormittal.com</a>	Mike Norstrem Air Quality Engineer Barr Engineering Co. 3128 14th Avenue East Hibbing, MN 55746 (218) 262-8760 <a href="mailto:Mnorstrem@barr.com">Mnorstrem@barr.com</a>