

**Results of the October 3-5, 2016 Baseline Mercury  
Emissions Tests Performed at Hibbing Taconite  
Company's Taconite Facility Located in Hibbing,  
Minnesota**

Pellet Indurating Furnace Line 2

SV025-SV028, EU021  
(STRU032-STRU035)

***Agency Interest ID: 1146***

***Air Emissions Permit No. 13700061-007***

***Barr Project No. 23691428.64***

Prepared for  
Hibbing Taconite Company  
Hibbing, Minnesota

April 2017



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## Contents

Executive Summary.....	1
1.0 Introduction .....	2
2.0 Results .....	3
2.1 Pellet Indurating Furnace Line 2 (SV025-SV028).....	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
Table 4-1	EPA Method 1 Criteria.....	5

## List of Tables

Table 1	Mercury and Particulate Matter Test Results – Pellet Indurating Furnace Line 2 – Stack 4 (SV025) Baseline
Table 2	Mercury and Particulate Matter Test Results – Pellet Indurating Furnace Line 2 – Stack 3 (SV026) Baseline
Table 3	Mercury and Particulate Matter Test Results – Pellet Indurating Furnace Line 2 – Stack 2 (SV027) Baseline
Table 4	Mercury and Particulate Matter Test Results – Pellet Indurating Furnace Line 2 – Stack 1 (SV028) Baseline

## List of Figures

Figure 1	Test Port Locations – Pellet Indurating Furnace Line 2 (SV025,026,027,028), (EU021)
Figure 2	Traverse Point Locations – Pellet Indurating Furnace Line 2 (SV025,026,027,028), (EU021)

## 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	Project Participants

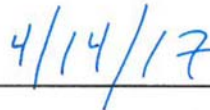
## Report Certification

### 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.



Thomas Leier  
Senior Air Quality Technician  
Barr Engineering Company

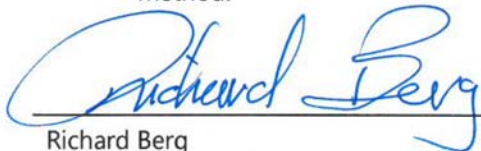


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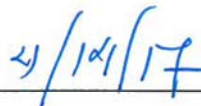
### Certification of Analytical Procedures:

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.

1. Enthalpy Analytical performed analysis for mercury using ASTM D6784-16 Ontario Hydro method.



Richard Berg  
Senior Air Quality Technician  
Barr Engineering Company



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.



Tom Kuchinski  
Stack Testing Services Coordinator  
Barr Engineering Company



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.



Julie Lucas  
Area Manager - Environmental  
Hibbing Taconite Co.



Date

## Executive Summary

Barr Engineering Company performed mercury emissions tests on October 3-5, 2016 at the Hibbing Taconite Company's taconite facility located in Hibbing, Minnesota. Emissions tests were performed on the Pellet Indurating Furnace Line 2 (EU021) stacks (SV025-SV028) to establish baseline mercury emissions. Determinations were made for filterable particulate matter, speciated and total mercury using ASTM D6784-16 Ontario Hydro test method.

Stack vent identification numbers, emission unit identification numbers, mercury and particulate matter test results are presented in Tables ES-1.

**Table ES-1      Executive Summary Table**

<b>Average Test Results – Baseline Testing</b>				
Test Parameter ASTM Ontario Hydro	Pellet Indurating Furnace Line 2			
Air Emissions Permit Group	GP003			
Stack Vent Number	SV025	SV026	SV027	SV028
Emission Unit	EU021			
Test Date	10/4-5/2016	10/3-4/2016	10/4-5/2016	10/3-4/2016
<b>Mercury Concentrations, ug/dscm</b>				
Particulate Hg	0.007	0.009	0.009	0.008
Oxidized Hg	0.58	0.59	0.38	0.20
Elemental Hg	6.1	4.9	2.4	1.5
Total Mercury	6.7	5.5	2.8	1.7
<b>Mercury Emission Rate, lb/hr</b>				
Particulate Hg	$3.9 \times 10^{-6}$	$5.3 \times 10^{-6}$	$6.0 \times 10^{-6}$	$5.1 \times 10^{-6}$
Oxidized Hg	$3.3 \times 10^{-4}$	$3.4 \times 10^{-4}$	$2.4 \times 10^{-4}$	$1.3 \times 10^{-4}$
Elemental Hg	$3.5 \times 10^{-3}$	$2.8 \times 10^{-3}$	$1.5 \times 10^{-3}$	$9.7 \times 10^{-4}$
Total Mercury	$3.8 \times 10^{-3}$	$3.1 \times 10^{-3}$	$1.7 \times 10^{-3}$	$1.1 \times 10^{-3}$
Estimated Annual Mercury Emissions, lb/yr <sup>1</sup>	33.3	27.4	15.3	9.7
<b>Particulate Concentration, gr/dscf</b>				
PM - Filterable	0.0047	0.0048	0.0041	0.0034
<b>Particulate Emissions Rate, lb/hr</b>				
PM - Filterable	6.1	6.2	5.9	5.0

1. Annual emissions calculated assuming 8760 operating hours/yr.

---

## 1.0 Introduction

Barr Engineering Company performed mercury emissions tests on October 3-5, 2016 at the Hibbing Taconite Company's taconite facility located in Hibbing, Minnesota. Emissions tests were performed on the Pellet Indurating Furnace Line 2 (EU021) stacks (SV025-SV028) to establish baseline filterable particulate and mercury emissions. Determinations of filterable particulate matter, speciated and total mercury were made using ASTM D6784-16 Ontario Hydro test method.

Tom Leier led the Barr test teams. Corie Ekholm of Hibbing Taconite Company provided the coordination of the test team with facility operations. A list of project participants is provided in Appendix F.

Each test consisted of three 120-minute test runs by ASTM D6784-16 Ontario Hydro including the determination of filterable particulate matter. Simultaneous tests runs were performed October 3-4, 2017 on Pellet Indurating Furnace Line 2 stacks SV026 and SV028. Simultaneous tests runs were performed October 4-5, 2017 on Pellet Indurating Furnace Line 2 stacks SV025 and SV027.



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## 2.0 Results

Mercury results are presented in micrograms per dry standard cubic meter (ug/dscm), pounds per hour (lb/hr), pounds per year (lb/yr) and pounds per dry standard ton fired pellets (lb Hg/ton fired pellets). Particulate results are presented in grains per dry standard cubic foot (gr/dscf) and lb/hr.

### 2.1 Pellet Indurating Furnace Line 2 (SV025-SV028)

Results of the October 3-5, 2016 mercury and particulate matter tests for SV025, SV026, SV027 and SV028 are provided in Table 1-4, respectively.

During run one at SV026 and SV028 on October 3, 2016, testing was paused from 1108-1242 due to process difficulties. No other test abnormalities or process delays were experienced for Pellet Indurating Furnace Line 2.

All sources were operating at normal conditions for this test series. Process data collected during the testing is provided in Appendix E.

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## 3.0 Process Description

Hibbing Taconite Company (HTC) mines iron ore (magnetite) and produces taconite pellets that are shipped to steel producers for processing in blast furnaces.

The Pellet Indurating Furnace Line 2 (EU021) is a straight grate induration furnace with four emission points; SV025, SV026, SV027 and SV028. Particulate emissions are controlled prior to each exhaust stack by a venturi rod deck wet scrubber. Prior to the scrubber, windbox exhaust air is pretreated to remove the coarse particulate matter by a multiclone.

Operating parameters for the process and control devices are provided in Appendix F.

## 4.0 Stack Testing Procedures and Methods

The testing was performed from ports meeting U.S. EPA Method 1 criteria. The U.S. EPA Method 1 criteria data are listed in Table 4-1. Sample port locations and traverse point details are provided in Figures 1-2.

Table 4-1 EPA Method 1 Criteria

Source/Emissions Unit (Plant or process descriptor)	Distance to Upstream Disturbances from Sample Site (In Diameters)	Distance to Downstream Disturbances from Sample Site (In Diameters)	Number of Ports	Number of Points
Pellet Indurating Furnace Line 2 (SV025-SV028)	8.6	1.8	2	12

Volumetric airflow determinations were performed in accordance with U.S. EPA Method 2 using an S type pitot tube. Airflows were determined in conjunction with the ASTM D6784-16 Ontario Hydro tests.

Stack gas oxygen and carbon dioxide compositions were determined using U.S. EPA Method 3A in conjunction with the ASTM D6784-16 Ontario Hydro method. An integrated sample of dry stack gas was collected in a Tedlar bag during each test run. The stack gas was analyzed for oxygen and carbon dioxide concentrations using a Servomex Model 1440 analyzer calibrated with EPA protocol gases. Instrument analysis data and calibrations are located in Appendix B gas certifications. Calibration gas certifications are located in Appendix D.

Stack gas moisture content was determined by the performance of U.S. EPA Method 4, in conjunction with the ASTM D6784-16 Ontario Hydro tests.

Particulate matter concentrations and emission rates were determined in accordance with U.S. EPA Method 5 as allowed in ASTM D6784-16 Ontario Hydro method. Particulate matter laboratory analysis was performed at Barr prior to mercury analysis.

Mercury concentrations and emission rates were determined in accordance with ASTM D6784-16 Ontario Hydro. All glassware and reagent preparation was completed by Barr laboratory facilities. Potassium permanganate sample reagents were prepared on-site daily. Sample recovery was completed within Barr's lab trailer on site to minimize contamination. Mercury samples were analyzed by Element One of Wilmington, North Carolina. A signed lab report for the mercury results summary is located in Appendix C.

The potassium permanganate reagent blank had a result slightly above the detection limit at 0.033 micrograms. This is expected to have little impact on the results relative to mass of mercury measured in the potassium permanganate fraction. The hydroxylamine recovery solution had detection for mercury in the 100 milliliter blank sample analyzed. Minimal impact on the results is expected as the amount used in sample recovery is 5-10 drops per test run. Blank corrections were not performed on the results.

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

## Tables

**TABLE 1**  
**MERCURY AND PARTICULATE MATTER TEST RESULTS**  
Pellet Indurating Furnace Line 2 - Stack 4 (SV025)

Test No. 4 - Baseline

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/4/2016	10/4/2016	10/5/2016	---
Test Period	1023 - 1228	1256 - 1503	745 - 950	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, deg.F	128	128	129	128
Avg. Moisture Content, %V/V	10.3	10.4	8.1	9.6
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO3)	< 0.010	< 0.010	< 0.010	< 0.010
Filter	< 0.005	0.006	0.007	0.006
Oxydized Mercury (KCl)	1.38	1.22	1.40	1.33
Elemental Mercury (HNO3/H2O2)	0.042	0.039	0.031	0.037
Elemental Mercury (KMnO4)	14.6	10.8	16.7	14.0
Total Mercury	16.0	12.1	18.1	15.4
Particulate Loading, g				
PM - Filterable	0.02699	0.02443	0.02270	0.02471
Air Flow Rate				
acfm	198,000	197,000	199,000	198,000
scfm	167,000	167,000	167,000	167,000
dscfm	150,000	149,000	153,000	151,000
Sample Volume				
acf	87.37	87.45	86.64	87.15
dscf	81.02	80.67	80.66	80.78
Isokinetic Variation, %				
	99.9	100.0	97.3	99.1
Mercury Concentrations, µg/dscm				
Particulate Hg	< 0.007	0.007	0.007	0.007
Oxidized Hg	0.60	0.53	0.61	0.58
Elemental Hg	6.4	4.7	7.3	6.1
Total Mercury	7.0	5.3	7.9	6.7
Mercury Emission Rate, lb/hr				
Particulate Hg	< 3.7E-06	3.8E-06	4.3E-06	3.9E-06
Oxidized Hg	3.4E-04	3.0E-04	3.5E-04	3.3E-04
Elemental Hg	3.6E-03	2.7E-03	4.2E-03	3.5E-03
Total Mercury	3.9E-03	3.0E-03	4.5E-03	3.8E-03
Estimated Annual Mercury Emissions, lb/yr*				
	34.2	25.9	39.8	33.3
*8760 hours of operation assumed				
Filterable PM Concentration, gr/dscf	0.0051	0.0047	0.0043	0.0047
Particulate (PM - Filterable) Emission Rate, lb/hr	6.6	6.0	5.7	6.1
Process Data				
Fired Pellet Production Rate, DSTPH	417	414	416	416
Mercury Emission Rate, lb Hg/ton fired pellets				
Total Mercury	9.4E-06	7.1E-06	1.1E-05	9.1E-06

**TABLE 2**  
**MERCURY AND PARTICULATE MATTER TEST RESULTS**  
Pellet Indurating Furnace Line 2 - Stack 3 (SV026)

Test No. 3 - Baseline

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/3/2016	10/3/2016	10/4/2016	---
Test Period	1035 - 1415	1505 - 1712	746 - 953	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, deg.F	121	122	121	121
Avg. Moisture Content, %V/V	8.6	8.6	8.8	8.7
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO3)	< 0.010	< 0.010	< 0.010	< 0.010
Filter	0.017	0.012	0.006	0.012
Oxydized Mercury (KCl)	1.4	1.4	1.3	1.4
Elemental Mercury (HNO3/H2O2)	0.031	0.027	0.036	0.031
Elemental Mercury (KMnO4)	11.2	11.8	11.1	11.3
Total Mercury	12.6	13.2	12.4	12.7
Particulate Loading, g				
PM - Filterable	0.02291	0.02487	0.02817	0.02532
Air Flow Rate				
acfm	192,000	192,000	198,000	194,000
scfm	165,000	165,000	169,000	166,000
dscfm	151,000	151,000	154,000	152,000
Sample Volume				
acf	87.89	89.76	87.66	88.44
dscf	81.20	80.99	83.07	81.75
Isokinetic Variation, %				
	99.4	99.2	99.6	99.4
Mercury Concentrations, µg/dscm				
Particulate Hg	0.012	0.010	0.007	0.009
Oxidized Hg	0.60	0.61	0.56	0.59
Elemental Hg	4.9	5.1	4.7	4.9
Total Mercury	5.5	5.8	5.3	5.5
Mercury Emission Rate, lb/hr				
Particulate Hg	6.5E-06	5.4E-06	3.9E-06	5.3E-06
Oxidized Hg	3.4E-04	3.4E-04	3.2E-04	3.4E-04
Elemental Hg	2.7E-03	2.9E-03	2.7E-03	2.8E-03
Total Mercury	3.1E-03	3.3E-03	3.0E-03	3.1E-03
Estimated Annual Mercury Emissions, lb/yr*				
	27.1	28.5	26.7	27.4
*8760 hours of operation assumed				
Filterable PM Concentration, gr/dscf	0.0044	0.0047	0.0052	0.0048
Particulate (PM - Filterable) Emission Rate, lb/hr	5.6	6.1	6.9	6.2
Process Data				
Fired Pellet Production Rate, DSTPH	419	416	418	418
Mercury Emission Rate, lb Hg/ton fired pellets				
Total Mercury	7.4E-06	7.8E-06	7.3E-06	7.5E-06

**TABLE 3**  
**MERCURY AND PARTICULATE MATTER TEST RESULTS**  
Pellet Indurating Furnace Line 2 - Stack 2 (SV027)

Test No. 2 - Baseline

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/4/2016	10/4/2016	10/5/2016	---
Test Period	1023 - 1228	1256 - 1503	745 - 950	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, deg.F	111	111	112	111
Avg. Moisture Content, %V/V	6.9	7.0	7.1	7.0
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO <sub>3</sub> )	< 0.010	< 0.010	0.01	0.01
Filter	0.012	0.013	0.013	0.012
Oxydized Mercury (KCl)	0.933	0.893	0.907	0.911
Elemental Mercury (HNO <sub>3</sub> /H <sub>2</sub> O <sub>2</sub> )	0.016	0.017	0.017	0.016
Elemental Mercury (KMnO <sub>4</sub> )	5.56	5.39	6.23	5.72
Total Mercury	6.52	6.32	7.17	6.67
Particulate Loading, g				
PM - Filterable	0.02395	0.02119	0.02188	0.02234
Air Flow Rate				
acfm	208,000	210,000	209,000	209,000
scfm	181,000	183,000	179,000	181,000
dscfm	168,000	170,000	167,000	168,000
Sample Volume				
acf	88.40	90.27	87.41	88.69
dscf	84.78	86.06	84.10	84.98
Isokinetic Variation, %				
	99.4	99.7	99.4	99.5
Mercury Concentrations, µg/dscm				
Particulate Hg	0.009	0.009	0.010	0.009
Oxidized Hg	0.39	0.37	0.38	0.38
Elemental Hg	2.3	2.2	2.6	2.4
Total Mercury	2.7	2.6	3.0	2.8
Mercury Emission Rate, lb/hr				
Particulate Hg	5.6E-06	6.0E-06	6.3E-06	6.0E-06
Oxidized Hg	2.4E-04	2.3E-04	2.4E-04	2.4E-04
Elemental Hg	1.5E-03	1.4E-03	1.6E-03	1.5E-03
Total Mercury	1.7E-03	1.7E-03	1.9E-03	1.7E-03
Estimated Annual Mercury Emissions, lb/yr*				
	15.0	14.5	16.5	15.3
*8760 hours of operation assumed				
Filterable PM Concentration, gr/dscf	0.0044	0.0038	0.0040	0.0041
Particulate (PM - Filterable) Emission Rate, lb/hr	6.3	5.5	5.7	5.9
Process Data				
Fired Pellet Production Rate, DSTPH	417	414	416	416
Mercury Emission Rate, lb Hg/ton fired pellets				
Total Mercury	4.1E-06	4.0E-06	4.5E-06	4.2E-06

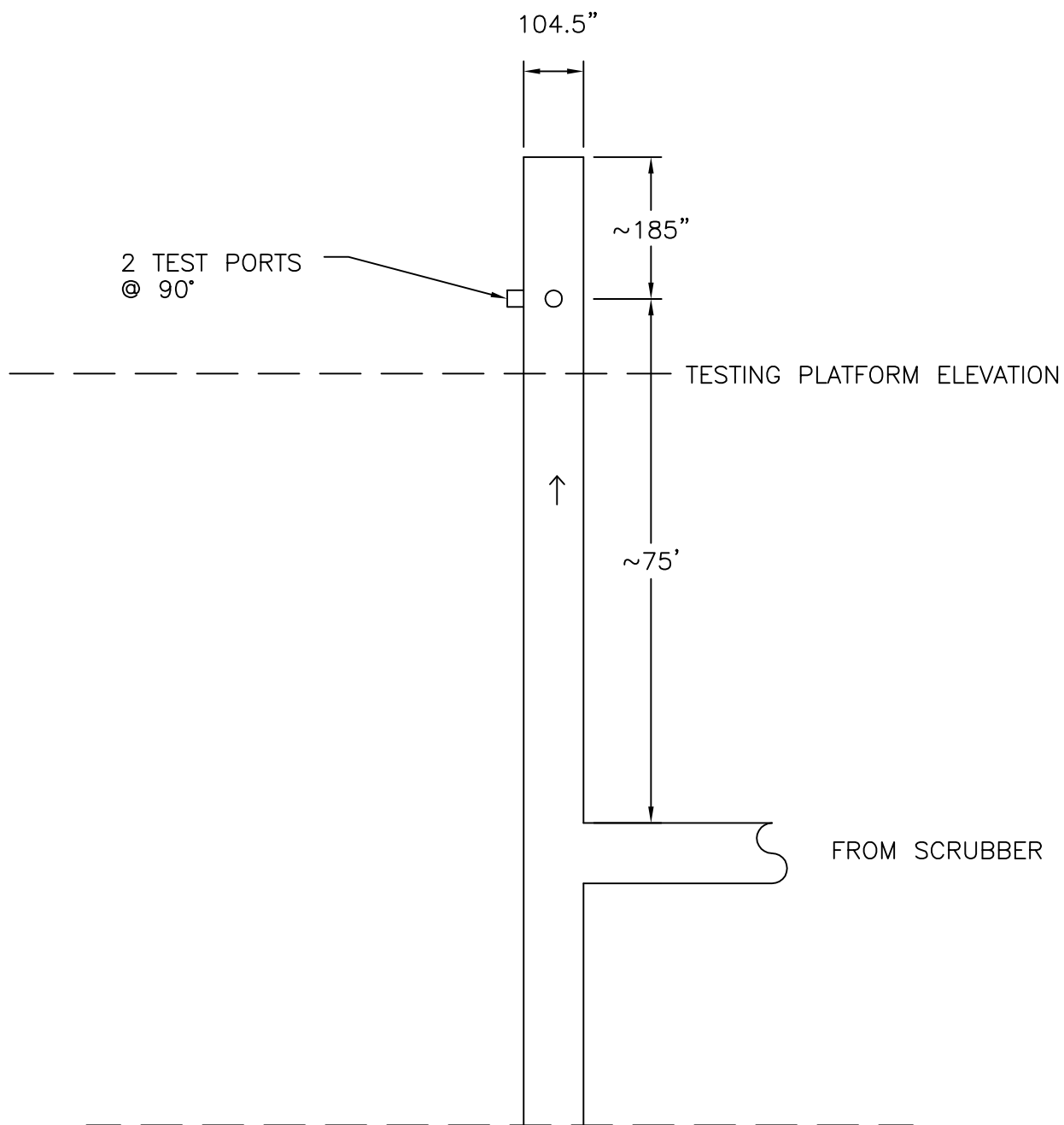


**TABLE 4**  
**MERCURY AND PARTICULATE MATTER TEST RESULTS**  
Pellet Indurating Furnace Line 2 - Stack 1 (SV028)

Test No. 1 - Baseline

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/3/2016	10/3/2016	10/4/2016	---
Test Period	1035 - 1415	1505 - 1712	746 - 953	---
Test Duration, min.	120	120	120	120
Avg. Stack Temperature, deg.F	100	100	100	100
Avg. Moisture Content, %V/V	5.9	6.0	5.9	5.9
Ontario Hydro Mercury Results, µg				
Probe Rinse (0.1 N HNO3)	< 0.010	< 0.010	< 0.010	< 0.010
Filter	0.010	0.009	0.010	0.009
Oxydized Mercury (KCl)	0.244	0.521	0.765	0.510
Elemental Mercury (HNO3/H2O2)	< 0.018	0.019	0.013	0.017
Elemental Mercury (KMnO4)	3.51	3.69	3.85	3.68
Total Mercury	3.79	4.24	4.64	4.22
Particulate Loading, g				
PM - Filterable	0.01996	0.01874	0.01913	0.01928
Air Flow Rate				
acfm	207,000	206,000	212,000	208,000
scfm	185,000	183,000	188,000	185,000
dscfm	174,000	172,000	176,000	174,000
Sample Volume				
acf	91.47	92.68	91.01	91.72
dscf	87.83	87.59	88.99	88.13
Isokinetic Variation, %				
	99.6	100.2	99.4	99.7
Mercury Concentrations, µg/dscm				
Particulate Hg	0.008	0.007	0.008	0.008
Oxidized Hg	0.10	0.21	0.30	0.20
Elemental Hg	1.4	1.5	1.5	1.5
Total Mercury	1.5	1.7	1.8	1.7
Mercury Emission Rate, lb/hr				
Particulate Hg	5.1E-06	4.8E-06	5.2E-06	5.1E-06
Oxidized Hg	6.4E-05	1.4E-04	2.0E-04	1.3E-04
Elemental Hg	9.2E-04	9.6E-04	1.0E-03	9.7E-04
Total Mercury	9.9E-04	1.1E-03	1.2E-03	1.1E-03
Estimated Annual Mercury Emissions, lb/yr*				
	8.7	9.7	10.7	9.7
*8760 hours of operation assumed				
Filterable PM Concentration, gr/dscf	0.0035	0.0033	0.0033	0.0034
Particulate (PM - Filterable) Emission Rate, lb/hr	5.2	4.9	5.0	5.0
Process Data				
Fired Pellet Production Rate, DSTPH	419	416	418	418
Mercury Emission Rate, lb Hg/ton fired pellets				
Total Mercury	2.4E-06	2.7E-06	2.9E-06	2.6E-06

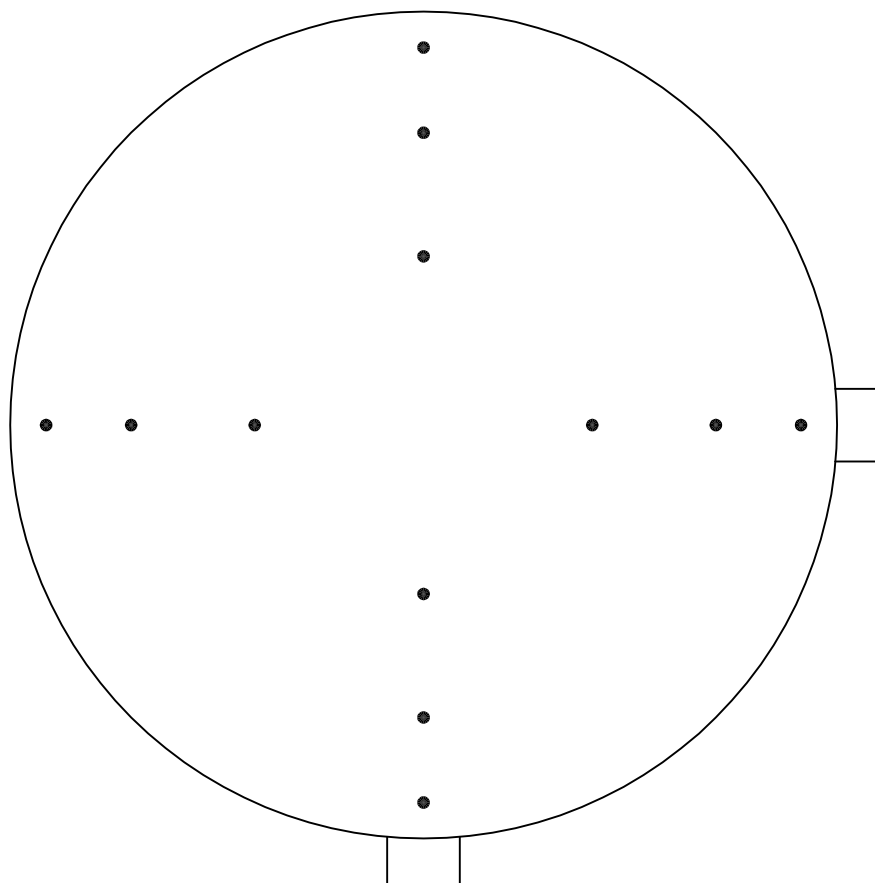
## Figures



TEST PORT LOCATIONS  
 HIBBING TACONITE COMPANY  
 HIBBING, MINNESOTA  
 PELLET INDURATING FURNACE LINE NO 2  
 (SV025,026,027,028), (EU021), (CE027,028,029,030)

NOT TO SCALE

FIGURE 1



● M2 POINTS

NO. OF TEST PORTS	2
PORT LENGTH	6.375"
PORT DIAMETER	6"
NO. OF TRAVERSE POINTS	12
DUCT DIAMETER	104.50"

POINT	INSERTION DEPTH IN "
1	4.55
2	15.30
3	30.92
4	73.58
5	89.20
6	99.95

TRAVERSE POINT LOCATIONS  
HIBBING TACONITE COMPANY  
HIBBING, MINNESOTA  
PELLET INDURATING FURNACE LINES 2  
(SV025,026,027,028), (EU021)

FIGURE 2

NOT TO SCALE

## Appendices

## **Appendix A**

### **Report Calculations and Nomenclature**

Determination of Volumetric Airflow Rate, Gas Composition, Moisture Content, and Speciated Mercury Emissions  
EPA Methods 2, 3, 4, Ontario-Hydro  
Test 4 - Baseline  
Pellet Indurating Furnace Line 2 - Stack 4 (SV025)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	10/4/2016	10/4/2016	10/5/2016
Test Period	-	-	1023 - 1228	1256 - 1503	745 - 950
Number of Sample Ports	-	-	2	2	2
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	104.50	104.50	104.50
Barometric Pressure	Pbar	in. Hg	28.18	28.18	27.92
Stack Static Pressure	Pg	in. H2O	-0.63	-0.63	-0.63
Average Stack Temperature, dry bulb	Tsf	degrees F	128	128	129
Actual Dry Gas Meter Volume	Vm	cubic feet	87.37	87.45	86.64
Dry Gas Meter Calibration Factor	Y	-	0.9799	0.9799	0.9799
Average Orifice Meter Pressure Drop	ΔH	in H2O	1.68	1.68	1.65
Average Meter Temperature	Tmf	degrees F	67.58	70.33	60.65
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(ΔP) <sup>0.5</sup>	-	0.888	0.886	0.895
Mass of Water Vapor Collected in Impingers and Desiccant	Vwc	g	197	200	150
Orsat Results, Dry Basis					
Oxygen	%O2	%v/v	19.1	19.1	19.1
Carbon Dioxide	%CO2	%v/v	0.8	0.8	0.8
Carbon Monoxide + Nitrogen	-	%v/v	80.1	80.1	80.1
Nozzle Diameter	Dn	in	0.222	0.222	0.222
Run Time	theta	min	120	120	120
Ontario Hydro Mercury Results					
Probe Rinse (0.1 N HNO3)	Hg <sub>pr</sub>	μg	< 0.010	< 0.010	< 0.010
Filter	Hg <sub>filter</sub>	μg	< 0.005	0.006	0.007
Oxydized Mercury (KCl)	Hg <sub>KCl</sub>	μg	1.38	1.22	1.40
Elemental Mercury (HNO3/H2O2)	Hg <sub>H2O2</sub>	μg	0.042	0.039	0.031
Elemental Mercury (KMnO4)	Hg <sub>KMnO4</sub>	μg	14.6	10.8	16.7
Total Mercury	Hg <sub>(total)</sub>	μg	16.0	12.1	18.1
Particulate Loading (From Lab Results)					
PM - Filterable	M <sub>PM</sub>	g	0.02699	0.02443	0.02270
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature (R)	Tsr	degrees R	588	588	589
Tsr = Tsf + 460					
Stack Pressure	Ps	in Hg	28.13	28.13	27.87
Ps = Pbar + Pg / 13.6					
Duct Area	A	Sq. ft	59.561	59.561	59.561
A = (D/24) <sup>2</sup> x π					
Meter Volume at Standard Conditions	Vmstd	cubic feet	81.02	80.67	80.66
Vmstd = 17.64 x Vm x Y x ((Pbar + (ΔH/13.6))/Tmr)					
Average Moisture Content of Stack Gas	MC	% Vol	10.29	10.44	8.05
MC = ((0.04715*Vwc)/((0.04715*Vwc) + (Vmstd))) x 100					
Molecular Weight of Stack Gas, dry	Md	lb/lbmol	28.89	28.89	28.89
Md = (0.44x(%CO2)) + (0.32x(%O2)) + (0.28x(%N2+%CO))					
Molecular Weight of Stack Gas, wet	Ms	lb/lbmol	27.77	27.75	28.02
Ms = Md x (1-(MC/100)) + 18 x (MC/100)					
Average Stack Gas Velocity	Vs	ft/sec	55.35	55.22	55.80
Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )					
Actual Volumetric Flowrate	Qa	acfm	197,802	197,326	199,411
Qa = 60 x Vs x A					
Volumetric Flowrate at Standard Conditions	Qs	scfm	166,990	166,506	166,651
Qs = Qa x (528/(Ts+460)) x (Ps/29.92)					
Dry Volumetric Flowrate at Standard Conditions	Qd	dscfm	149,799	149,119	153,233
Qd = Qa x (1-(MC/100)) x (528/Tsr) x (Ps/29.92)					
Nozzle Cross-Sectional Area	An	sq. ft	0.000269	0.000269	0.000269
An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)					
Isokinetic Variation	I	%	99.9	100.0	97.3
I = ((0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1-(MC/100))))					
Mercury Concentrations					
Particulate Hg: Hg <sup>P</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) / (Vmstd / 35.314)	Hg <sup>P</sup>	μg/dscm	< 0.007	< 0.007	< 0.007
Oxidized Hg: Hg <sup>O</sup> = Hg <sub>KCl</sub> / (Vmstd / 35.314)	Hg <sup>O</sup>	μg/dscm	0.6	0.5	0.6
Elemental Hg: Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) / (Vmstd / 35.314)	Hg <sup>E</sup>	μg/dscm	6.4	4.7	7.3
Total Hg: Hg <sup>tot</sup> = Hg <sub>(total)</sub> / (Vmstd / 35.314)	Hg <sup>tot</sup>	μg/dscm	7.0	5.3	7.9
Mercury Emission Rates					
Particulate Hg: E-Hg <sup>P</sup> = Hg <sup>P</sup> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>P</sup>	lb/hr	< 3.7E-06	< 3.8E-06	< 4.3E-06
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>O</sup>	lb/hr	3.4E-04	3.0E-04	3.5E-04
Elemental Hg: E-Hg <sup>E</sup> = Hg <sub>H2O2</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>E</sup>	lb/hr	3.6E-03	2.7E-03	4.2E-03
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>tot</sup>	lb/hr	3.9E-03	3.0E-03	4.5E-03
Estimated Annual Mercury Emissions					
E-Hg <sup>tot</sup> = 8,760 hr/yr x E-Hg <sup>tot</sup>	E-Hg <sup>tot</sup>	lb/yr	34.2	25.9	39.8
PARTICULATE CONCENTRATION					
PM - Filterable	C <sub>sPM</sub>	gr/dscf	0.0051	0.0047	0.0043
C <sub>sPM</sub> = 15.432 x M <sub>PM</sub> / V <sub>mstd</sub>					
PARTICULATE EMISSION RATE					
PM - Filterable	E <sub>dry</sub>	lb/hr	6.6	6.0	5.7
E <sub>dry</sub> (lb/hr) = C <sub>sPM</sub> x Q <sub>d</sub> x 60 / 7000					

Determination of Volumetric Airflow Rate, Gas Composition, Moisture Content, and Speciated Mercury Emissions  
EPA Methods 2, 3, 4, Ontario-Hydro  
Test 3 - Baseline  
Pellet Indurating Furnace Line 2 - Stack 3 (SV026)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	10/3/2016	10/3/2016	10/4/2016
Test Period	-	-	1035 - 1415	1505 - 1712	746 - 953
Number of Sample Ports	-	-	2	2	2
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	104.50	104.50	104.50
Barometric Pressure	Pbar	in. Hg	28.33	28.33	28.18
Stack Static Pressure	Pg	in. H2O	-0.65	-0.65	-0.65
Average Stack Temperature, dry bulb	Tsf	degrees F	121	122	121
Actual Dry Gas Meter Volume	Vm	cubic feet	87.89	89.76	87.66
Dry Gas Meter Calibration Factor	Y	-	0.9799	0.9799	0.9799
Average Orifice Meter Pressure Drop	ΔH	in H2O	1.69	1.73	1.72
Average Meter Temperature	Tmf	degrees F	72.40	85.17	56.31
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(ΔP) <sup>0.5</sup>	-	0.874	0.874	0.896
Mass of Water Vapor Collected in Impingers and Desiccant	Vwc	g	163	162	170
Orsat Results, Dry Basis					
Oxygen	%O2	%v/v	19.5	19.5	19.5
Carbon Dioxide	%CO2	%v/v	0.6	0.6	0.6
Carbon Monoxide + Nitrogen	-	%v/v	79.9	79.9	79.9
Nozzle Diameter	Dn	in	0.222	0.222	0.222
Run Time	theta	min	120	120	120
Ontario Hydro Mercury Results					
Probe Rinse (0.1 N HNO3)	Hg <sub>pr</sub>	μg	< 0.010	< 0.010	< 0.010
Filter	Hg <sub>filter</sub>	μg	0.017	0.012	0.006
Oxydized Mercury (KCl)	Hg <sub>KCl</sub>	μg	1.39	1.40	1.31
Elemental Mercury (HNO3/H2O2)	Hg <sub>H2O2</sub>	μg	0.031	0.027	0.036
Elemental Mercury (KMnO4)	Hg <sub>KMnO4</sub>	μg	11.2	11.8	11.1
Total Mercury	Hg <sub>(total)</sub>	μg	12.6	13.2	12.4
Particulate Loading (From Lab Results)					
PM - Filterable	M <sub>PM</sub>	g	0.02291	0.02487	0.02817
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature (R)	Tsr	degrees R	581	582	581
Tsr = Tsf + 460					
Stack Pressure	Ps	in Hg	28.28	28.28	28.13
Ps = Pbar + Pg / 13.6					
Duct Area	A	Sq. ft	59.561	59.561	59.561
A = (D/24) <sup>2</sup> x π					
Meter Volume at Standard Conditions	Vmstd	cubic feet	81.20	80.99	83.07
Vmstd = 17.64 x Vm x Y x ((Pbar + (ΔH/13.6))/Tmr)					
Average Moisture Content of Stack Gas	MC	% Vol	8.65	8.62	8.80
MC = ((0.04715*Vwc)/((0.04715*Vwc) + (Vmstd))) x 100					
Molecular Weight of Stack Gas, dry	Md	lb/lbmol	28.88	28.88	28.88
Md = (0.44x(%CO2)) + (0.32x(%O2)) + (0.28x(%N2+%CO))					
Molecular Weight of Stack Gas, wet	Ms	lb/lbmol	27.94	27.94	27.92
Ms = Md x (1-(MC/100)) + 18 x (MC/100)					
Average Stack Gas Velocity	Vs	ft/sec	53.79	53.85	55.37
Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )					
Actual Volumetric Flowrate	Qa	acfm	192,230	192,452	197,865
Qa = 60 x Vs x A					
Volumetric Flowrate at Standard Conditions	Qs	scfm	165,250	165,109	169,059
Qs = Qa x (528/(Ts+460)) x (Ps/29.92)					
Dry Volumetric Flowrate at Standard Conditions	Qd	dscfm	150,961	150,871	154,174
Qd = Qa x (1-(MC/100)) x (528/Tsr) x (Ps/29.92)					
Nozzle Cross-Sectional Area	An	sq. ft	0.000269	0.000269	0.000269
An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)					
Isokinetic Variation	I	%	99.4	99.2	99.6
I = (0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1-(MC/100)))					
Mercury Concentrations					
Particulate Hg: E-Hg <sup>P</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) / (Vmstd / 35.314)	Hg <sup>P</sup>	μg/dscm	< 0.012	< 0.010	< 0.007
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> / (Vmstd / 35.314)	Hg <sup>O</sup>	μg/dscm	0.60	0.61	0.56
Elemental Hg: E-Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) / (Vmstd / 35.314)	Hg <sup>E</sup>	μg/dscm	4.9	5.1	4.7
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> / (Vmstd / 35.314)	Hg <sup>tot</sup>	μg/dscm	5.5	5.8	5.3
Mercury Emission Rates					
Particulate Hg: E-Hg <sup>P</sup> = Hg <sup>P</sup> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>P</sup>	lb/hr	< 6.5E-06	< 5.4E-06	< 3.9E-06
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>O</sup>	lb/hr	3.4E-04	3.4E-04	3.2E-04
Elemental Hg: E-Hg <sup>E</sup> = Hg <sub>H2O2</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>E</sup>	lb/hr	2.7E-03	2.9E-03	2.7E-03
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>tot</sup>	lb/hr	3.1E-03	3.3E-03	3.0E-03
Estimated Annual Mercury Emissions					
E-Hg <sup>tot</sup> = 8,760 hr/yr x E-Hg <sup>tot</sup>	E-Hg <sup>tot</sup>	lb/yr	27.1	28.5	26.7
PARTICULATE CONCENTRATION					
PM - Filterable	C <sub>SPM</sub>	gr/dscf	0.0044	0.0047	0.0052
C <sub>SPM</sub> = 15.432 x M <sub>PM</sub> / V <sub>mstd</sub>					
PARTICULATE EMISSION RATE					
PM - Filterable	E <sub>dry</sub>	lb/hr	5.6	6.1	6.9
E <sub>dry</sub> (lb/hr) = C <sub>SPM</sub> x Q <sub>d</sub> x 60 / 7000					



Determination of Volumetric Airflow Rate, Gas Composition, Moisture Content, and Speciated Mercury Emissions  
EPA Methods 2, 3, 4, Ontario-Hydro  
Test 2 - Baseline  
Pellet Indurating Furnace Line 2 - Stack 2 (SV027)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	10/4/2016	10/4/2016	10/5/2016
Test Period	-	-	1023 - 1228	1256 - 1503	745 - 950
Number of Sample Ports	-	-	2	2	2
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	104.50	104.50	104.50
Barometric Pressure	Pbar	in. Hg	28.18	28.18	27.92
Stack Static Pressure	Pg	in. H2O	-0.80	-0.80	-0.80
Average Stack Temperature, dry bulb	Tsf	degrees F	111	111	112
Actual Dry Gas Meter Volume	Vm	cubic feet	88.40	90.27	87.41
Dry Gas Meter Calibration Factor	Y	-	1.0100	1.0100	1.0100
Average Orifice Meter Pressure Drop	ΔH	in H2O	1.78	1.85	1.75
Average Meter Temperature	Tmf	degrees F	65.94	69.19	59.40
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(ΔP) <sup>0.5</sup>	-	0.952	0.965	0.951
Mass of Water Vapor Collected in Impingers and Desiccant	Vwc	g	134	138	136
Orsat Results, Dry Basis					
Oxygen	%O2	%v/v	20.0	20.0	20.0
Carbon Dioxide	%CO2	%v/v	0.4	0.4	0.4
Carbon Monoxide + Nitrogen	-	%v/v	79.6	79.6	79.6
Nozzle Diameter	Dn	in	0.215	0.215	0.215
Run Time	theta	min	120	120	120
Ontario Hydro Mercury Results					
Probe Rinse (0.1 N HNO3)	Hg <sub>pr</sub>	μg	< 0.010	< 0.010	0.011
Filter	Hg <sub>filter</sub>	μg	0.012	0.013	0.013
Oxydized Mercury (KCl)	Hg <sub>KCl</sub>	μg	0.933	0.893	0.907
Elemental Mercury (HNO3/H2O2)	Hg <sub>H2O2</sub>	μg	0.016	0.017	0.017
Elemental Mercury (KMnO4)	Hg <sub>KMnO4</sub>	μg	5.56	5.39	6.23
Total Mercury	Hg <sub>(total)</sub>	μg	6.52	6.32	7.17
Particulate Loading (From Lab Results)					
PM - Filterable	M <sub>PM</sub>	g	0.02395	0.02119	0.02188
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature (R)	Tsr	degrees R	571	571	572
Tsr = Tsf + 460					
Stack Pressure	Ps	in Hg	28.12	28.12	27.86
Ps = Pbar + Pg / 13.6					
Duct Area	A	Sq. ft	59.561	59.561	59.561
A = (D/24) <sup>2</sup> x π					
Meter Volume at Standard Conditions	Vmstd	cubic feet	84.78	86.06	84.10
Vmstd = 17.64 x Vm x Y x ((Pbar + (ΔH/13.6))/Tmr)					
Average Moisture Content of Stack Gas	MC	% Vol	6.92	7.04	7.10
MC = ((0.04715*Vwc)/((0.04715*Vwc) + (Vmstd))) x 100					
Molecular Weight of Stack Gas, dry	Md	lb/lbmol	28.86	28.86	28.86
Md = (0.44x(%CO2)) + (0.32x(%O2)) + (0.28x(%N2+%CO))					
Molecular Weight of Stack Gas, wet	Ms	lb/lbmol	28.11	28.10	28.09
Ms = Md x (1-(MC/100)) + 18 x (MC/100)					
Average Stack Gas Velocity	Vs	ft/sec	58.13	58.89	58.36
Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )					
Actual Volumetric Flowrate	Qa	acfm	207,741	210,448	208,559
Qa = 60 x Vs x A					
Volumetric Flowrate at Standard Conditions	Qs	scfm	180,535	182,967	179,360
Qs = Qa x (528/(Ts+460)) x (Ps/29.92)					
Dry Volumetric Flowrate at Standard Conditions	Qd	dscfm	168,040	170,088	166,619
Qd = Qa x (1-(MC/100)) x (528/Tsr) x (Ps/29.92)					
Nozzle Cross-Sectional Area	An	sq. ft	0.000252	0.000252	0.000252
An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)					
Isokinetic Variation	I	%	99.4	99.7	99.4
I = ((0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1-(MC/100))))					
Mercury Concentrations					
Particulate Hg: E-Hg <sup>P</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) / (Vmstd / 35.314)	Hg <sup>P</sup>	μg/dscm	< 0.009	< 0.009	0.010
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> / (Vmstd / 35.314)	Hg <sup>O</sup>	μg/dscm	0.39	0.37	0.38
Elemental Hg: E-Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) / (Vmstd / 35.314)	Hg <sup>E</sup>	μg/dscm	2.3	2.2	2.6
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> / (Vmstd / 35.314)	Hg <sup>tot</sup>	μg/dscm	2.7	2.6	3.0
Mercury Emission Rates					
Particulate Hg: E-Hg <sup>P</sup> = Hg <sup>P</sup> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>P</sup>	lb/hr	< 5.6E-06	< 6.0E-06	6.3E-06
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>O</sup>	lb/hr	2.4E-04	2.3E-04	2.4E-04
Elemental Hg: E-Hg <sup>E</sup> = Hg <sub>H2O2</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>E</sup>	lb/hr	1.5E-03	1.4E-03	1.6E-03
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>tot</sup>	lb/hr	1.7E-03	1.7E-03	1.9E-03
Estimated Annual Mercury Emissions					
E-Hg <sup>tot</sup> = 8,760 hr/yr x E-Hg <sup>tot</sup>	E-Hg <sup>tot</sup>	lb/yr	15.0	14.5	16.5
PARTICULATE CONCENTRATION					
PM - Filterable	C <sub>SPM</sub>	gr/dscf	0.0044	0.0038	0.0040
C <sub>SPM</sub> = 15.432 x M <sub>PM</sub> / V <sub>mstd</sub>					
PARTICULATE EMISSION RATE					
PM - Filterable	E <sub>dry</sub>	lb/hr	6.3	5.5	5.7
E <sub>dry</sub> (lb/hr) = C <sub>SPM</sub> x Q <sub>d</sub> x 60 / 7000					

Determination of Volumetric Airflow Rate, Gas Composition, Moisture Content, and Speciated Mercury Emissions  
EPA Methods 2, 3, 4, Ontario-Hydro  
Test 1 - Baseline  
Pellet Indurating Furnace Line 2 - Stack 1 (SV028)

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test Date	-	-	10/3/2016	10/3/2016	10/4/2016
Test Period	-	-	1035 - 1415	1505 - 1712	746 - 953
Number of Sample Ports	-	-	2	2	2
Number of Traverse Points	-	-	12	12	12
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	104.50	104.50	104.50
Barometric Pressure	Pbar	in. Hg	28.33	28.33	28.18
Stack Static Pressure	Pg	in. H2O	-0.83	-0.83	-0.83
Average Stack Temperature, dry bulb	Tsf	degrees F	100	100	100
Actual Dry Gas Meter Volume	Vm	cubic feet	91.47	92.68	91.01
Dry Gas Meter Calibration Factor	Y	-	1.0100	1.0100	1.0100
Average Orifice Meter Pressure Drop	ΔH	in H2O	1.92	1.92	1.93
Average Meter Temperature	Tmf	degrees F	68.29	76.75	56.06
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(ΔP) <sup>0.5</sup>	-	0.963	0.957	0.981
Mass of Water Vapor Collected in Impingers and Desiccant	Vwc	g	116	120	119
Orsat Results, Dry Basis					
Oxygen	%O2	%v/v	20.2	20.2	20.2
Carbon Dioxide	%CO2	%v/v	0.3	0.3	0.3
Carbon Monoxide + Nitrogen	-	%v/v	79.5	79.5	79.5
Nozzle Diameter	Dn	in	0.215	0.215	0.215
Run Time	theta	min	120	120	120
Ontario Hydro Mercury Results					
Probe Rinse (0.1 N HNO3)	Hg <sub>pr</sub>	μg	< 0.010	< 0.010	< 0.010
Filter	Hg <sub>filter</sub>	μg	0.010	0.009	0.010
Oxydized Mercury (KCl)	Hg <sub>KCl</sub>	μg	0.244	0.521	0.765
Elemental Mercury (HNO3/H2O2)	Hg <sub>H2O2</sub>	μg	< 0.018	0.019	0.013
Elemental Mercury (KMnO4)	Hg <sub>KMnO4</sub>	μg	3.51	3.69	3.85
Total Mercury	Hg <sub>(total)</sub>	μg	3.79	4.24	4.64
Particulate Loading (From Lab Results)					
PM - Filterable	M <sub>PM</sub>	g	0.01996	0.01874	0.01913
Calculated Data	Symbol	Units	Run 1	Run 2	Run 3
Average Absolute Stack Temperature (R)	Tsr	degrees R	560	560	560
Tsr = Tsf + 460					
Stack Pressure	Ps	in Hg	28.27	28.27	28.12
Ps = Pbar + Pg / 13.6					
Duct Area	A	Sq. ft	59.561	59.561	59.561
A = (D/24) <sup>2</sup> x π					
Meter Volume at Standard Conditions	Vmstd	cubic feet	87.83	87.59	88.99
Vmstd = 17.64 x Vm x Y x ((Pbar + (ΔH/13.6))/Tmr)					
Average Moisture Content of Stack Gas	MC	% Vol	5.86	6.04	5.93
MC = ((0.04715*Vwc)/((0.04715*Vwc) + (Vmstd))) x 100					
Molecular Weight of Stack Gas, dry	Md	lb/lbmol	28.86	28.86	28.86
Md = (0.44x(%CO2)) + (0.32x(%O2)) + (0.28x(%N2+%CO))					
Molecular Weight of Stack Gas, wet	Ms	lb/lbmol	28.22	28.20	28.21
Ms = Md x (1-(MC/100)) + 18 x (MC/100)					
Average Stack Gas Velocity	Vs	ft/sec	57.94	57.64	59.21
Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )					
Actual Volumetric Flowrate	Qa	acfm	207,071	205,996	211,581
Qa = 60 x Vs x A					
Volumetric Flowrate at Standard Conditions	Qs	scfm	184,575	183,357	187,510
Qs = Qa x (528/(Ts+460)) x (Ps/29.92)					
Dry Volumetric Flowrate at Standard Conditions	Qd	dscfm	173,754	172,275	176,388
Qd = Qa x (1-(MC/100)) x (528/Tsr) x (Ps/29.92)					
Nozzle Cross-Sectional Area	An	sq. ft	0.000252	0.000252	0.000252
An = (3.14 x Dn <sup>2</sup> ) / (4 x 144)					
Isokinetic Variation	I	%	99.6	100.2	99.4
I = ((0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1-(MC/100))))					
Mercury Concentrations					
Particulate Hg: Hg <sup>P</sup> = (Hg <sub>pr</sub> + Hg <sub>filter</sub> ) / (Vmstd / 35.314)	Hg <sup>P</sup>	μg/dscm	< 0.008	< 0.007	< 0.008
Oxidized Hg: Hg <sup>O</sup> = Hg <sub>KCl</sub> / (Vmstd / 35.314)	Hg <sup>O</sup>	μg/dscm	0.1	0.2	0.3
Elemental Hg: Hg <sup>E</sup> = (Hg <sub>H2O2</sub> + Hg <sub>KMnO4</sub> ) / (Vmstd / 35.314)	Hg <sup>E</sup>	μg/dscm	1.4	1.5	1.5
Total Hg: Hg <sup>tot</sup> = Hg <sub>(total)</sub> / (Vmstd / 35.314)	Hg <sup>tot</sup>	μg/dscm	1.5	1.7	1.8
Mercury Emission Rates					
Particulate Hg: E-Hg <sup>P</sup> = Hg <sup>P</sup> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>P</sup>	lb/hr	< 5.1E-06	< 4.8E-06	< 5.2E-06
Oxidized Hg: E-Hg <sup>O</sup> = Hg <sub>KCl</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>O</sup>	lb/hr	6.4E-05	1.4E-04	2.0E-04
Elemental Hg: E-Hg <sup>E</sup> = Hg <sub>H2O2</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>E</sup>	lb/hr	9.2E-04	9.6E-04	1.0E-03
Total Hg: E-Hg <sup>tot</sup> = Hg <sub>(total)</sub> x 62.43x10 <sup>-12</sup> x 60 x dscfm	E-Hg <sup>tot</sup>	lb/hr	9.9E-04	1.1E-03	1.2E-03
Estimated Annual Mercury Emissions					
E-Hg <sup>tot</sup> = 8,760 hr/yr x E-Hg <sup>tot</sup>	E-Hg <sup>tot</sup>	lb/yr	8.7	9.7	10.7
PARTICULATE CONCENTRATION					
PM - Filterable	C <sub>SPM</sub>	gr/dscf	0.0035	0.0033	0.0033
C <sub>SPM</sub> = 15.432 x M <sub>PM</sub> / V <sub>mstd</sub>					
PARTICULATE EMISSION RATE					
PM - Filterable	E <sub>dry</sub>	lb/hr	5.2	4.9	5.0
E <sub>dry</sub> (lb/hr) = C <sub>SPM</sub> x Q <sub>d</sub> x 60 / 7000					

## **Appendix B**

### **Field Data Sheets**

EPA METHOD 2  
FIELD DATA SHEET



## EPA METHOD 5 - FIELD DATA SHEET - RUN 1

Project	Hibbing Taconite Company	Meter ID	C-8	Probe ID	10-3	Bar.Press.	28.18	in. Hg	Sample Train Leak	Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 4 SV025	Meter Y	0.9799	Pitot Tube No.	10-3	Stat Press.	-0.6	in. H2O	Pretest	0.000 at 10 in. Hg
Date	10/04/16	Orifice dH@	1.9256	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000 at 7 in. Hg
Test	4 - Baseline Run # 1			Liner Type:	Glass	IMP Out TC	6001		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	0:00	42.11												
1	5.0	45.73	0.800	1.69	3.65	45.76	*	125	*	*	*	61	60	9.5
2	10.0	49.41	0.820	1.73	3.70	49.46	*	126	*	*	*	61	60	9.5
3	15.0	53.15	0.840	1.77	3.74	53.20	*	127	*	*	*	63	61	9.5
4	20.0	56.90	0.850	1.79	3.77	56.97	*	127	*	*	*	65	61	9.5
5	25.0	60.63	0.860	1.81	3.80	60.77	*	128	*	*	*	66	62	9.5
6	30.0	64.52	0.910	1.92	3.91	64.68	*	128	*	*	*	68	63	9.5
7	35.0	68.18	0.800	1.69	3.68	68.36	*	129	*	*	*	69	63	9.5
8	40.0	71.80	0.800	1.69	3.68	72.04	*	129	*	*	*	69	64	9.5
9	45.0	75.20	0.740	1.57	3.55	75.59	*	128	*	*	*	70	64	9.5
10	50.0	78.65	0.750	1.59	3.58	79.16	*	128	*	*	*	70	65	9.5
11	55.0	82.02	0.680	1.45	3.41	82.57	*	128	*	*	*	71	66	9.5
12	60.0	85.30	0.660	1.41	3.37	85.94	*	127	*	*	*	71	66	9.5
13	65.0	88.72	0.740	1.58	3.56	89.50	*	127	*	*	*	70	67	9.5
14	70.0	92.27	0.750	1.60	3.59	93.09	*	128	*	*	*	70	67	9.5
15	75.0	96.09	0.830	1.77	3.77	96.86	*	128	*	*	*	71	67	9.5
16	80.0	99.93	0.840	1.79	3.79	100.65	*	129	*	*	*	72	68	9.5
17	85.0	103.68	0.830	1.77	3.78	104.43	*	129	*	*	*	72	68	9.5
18	90.0	107.68	0.860	1.83	3.84	108.28	*	129	*	*	*	73	68	9.5
19	95.0	111.52	0.840	1.79	3.80	112.08	*	129	*	*	*	73	68	9.5
20	100.0	115.24	0.800	1.71	3.71	115.79	*	129	*	*	*	73	69	9.5
21	105.0	118.75	0.750	1.60	3.60	119.39	*	129	*	*	*	73	69	9.5
22	110.0	122.30	0.740	1.58	3.58	122.97	*	129	*	*	*	73	69	9.5
23	115.0	125.92	0.740	1.58	3.58	126.54	*	129	*	*	*	74	69	9.5
24	120.0	129.48	0.740	1.58	3.58	130.12	*	129	*	*	*	73	69	9.5
End Time	0:00													
Run Time	120		Avg DH=	1.68			Avg Ts=	128.08				Avg Tm=	67.58	

Integrated Gas Sampling Data :

Bag No.	T4-R1
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0609
Nozzle No.	glass
Nozzle Dn.	0.222

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
934.6	783.8	771.1	765.0	749.7	756.7	777.8	1003.4	
799.7	752.3	764.3	760.5	750.2	754.8	778.0	985.1	
134.9	31.5	6.8	4.5	-0.5	1.9	-0.2	18.3	197.2

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 2

Project	Hibbing Taconite Company	Meter ID	C-8	Probe ID	10-3	Bar.Press.	28.18	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 4 SV025	Meter Y	0.9799	Pitot Tube No.	10-3	Stat Press.	-0.6	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/04/16	Orifice dH@	1.9256	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 8 in. Hg
Test	4 - Baseline Run # 2			Liner Type:	Glass	IMP Out TC	6001		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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	129.73												
1	5.0	133.33	0.760	1.62	3.61	133.34	*	128	*	*	*	67	67	9.5
2	10.0	136.93	0.750	1.60	3.58	136.91	*	127	*	*	*	67	67	9.5
3	15.0	140.75	0.840	1.78	3.78	140.70	*	128	*	*	*	68	67	9.5
4	20.0	144.50	0.860	1.83	3.83	144.53	*	128	*	*	*	69	67	9.5
5	25.0	148.36	0.860	1.83	3.83	148.36	*	128	*	*	*	69	67	9.5
6	30.0	152.21	0.860	1.83	3.83	152.19	*	128	*	*	*	70	67	9.5
7	35.0	156.03	0.810	1.73	3.72	155.92	*	128	*	*	*	70	67	9.5
8	40.0	159.71	0.810	1.73	3.72	159.64	*	128	*	*	*	71	67	9.5
9	45.0	163.41	0.780	1.66	3.66	163.30	*	128	*	*	*	71	67	9.5
10	50.0	166.92	0.750	1.60	3.59	166.89	*	129	*	*	*	71	68	9.5
11	55.0	170.31	0.690	1.47	3.45	170.34	*	128	*	*	*	71	68	9.5
12	60.0	173.63	0.690	1.47	3.45	173.78	*	128	*	*	*	72	68	9.5
13	65.0	177.50	0.830	1.77	3.78	177.56	*	128	*	*	*	70	68	9.5
14	70.0	181.22	0.860	1.83	3.84	181.40	*	128	*	*	*	70	68	9.5
15	75.0	185.00	0.850	1.81	3.82	185.22	*	128	*	*	*	72	68	9.5
16	80.0	188.77	0.840	1.79	3.80	189.03	*	128	*	*	*	73	69	9.5
17	85.0	192.62	0.860	1.84	3.85	192.88	*	129	*	*	*	74	69	9.5
18	90.0	196.40	0.850	1.82	3.83	196.71	*	129	*	*	*	74	70	9.5
19	95.0	200.06	0.780	1.67	3.67	200.38	*	130	*	*	*	75	71	9.5
20	100.0	203.63	0.800	1.72	3.73	204.11	*	129	*	*	*	75	71	9.5
21	105.0	207.14	0.730	1.57	3.56	207.68	*	129	*	*	*	76	72	9.5
22	110.0	210.67	0.740	1.59	3.60	211.28	*	129	*	*	*	76	72	9.5
23	115.0	213.92	0.640	1.38	3.35	214.62	*	129	*	*	*	77	73	9.5
24	120.0	217.18	0.630	1.36	3.33	217.95	*	129	*	*	*	77	73	9.5
End Time	0:00													
Run Time	120		Avg DH=	1.68			Avg Ts=	128.38				Avg Tm=	70.33	

## Integrated Gas Sampling Data :

Bag No. T4-R2  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0610  
Nozzle No. glass  
Nozzle Dn. 0.222

## MOISTURE RECOVERY DATA :

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g	859.1	804.4	772.9	761.6	761.1	763.7	776.8	978.3	
Initial wt., g	751.3	758.3	761.6	753.7	759.9	762.4	777.4	953.8	
Difference	107.8	46.1	11.3	7.9	1.2	1.3	-0.6	24.5	199.5

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 3

Project	Hibbing Taconite Company	Meter ID	C-8	Probe ID	10-3	Bar.Press.	27.92	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 4 SV025	Meter Y	0.9799	Pitot Tube No.	10-3	Stat Press.	-0.6	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/05/16	Orifice dH@	1.9256	Pitot Cp	0.84	CPM TC	NA	Posttest 0.000 at 6 in. Hg	
Test	4 - Baseline Run # 3			Liner Type:	Glass	IMP Out TC	6001	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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00													
1	5.0	220.88	0.750	1.54	3.49	220.88	*	127	*	*	*	56	56	10.4
2	10.0	224.38	0.750	1.54	3.49	224.37	*	127	*	*	*	56	56	10.4
3	15.0	228.02	0.840	1.72	3.69	228.06	*	128	*	*	*	57	56	10.4
4	20.0	231.89	0.870	1.78	3.76	231.82	*	128	*	*	*	58	57	10.4
5	25.0	235.70	0.880	1.80	3.78	235.60	*	129	*	*	*	60	57	10.4
6	30.0	239.35	0.870	1.78	3.77	239.37	*	129	*	*	*	61	57	10.4
7	35.0	242.88	0.810	1.66	3.64	243.01	*	130	*	*	*	62	58	10.4
8	40.0	246.70	0.840	1.73	3.71	246.72	*	129	*	*	*	62	58	10.4
9	45.0	250.03	0.720	1.48	3.44	250.16	*	129	*	*	*	63	58	10.4
10	50.0	253.67	0.770	1.59	3.56	253.72	*	129	*	*	*	63	59	10.4
11	55.0	256.91	0.680	1.40	3.35	257.08	*	129	*	*	*	64	59	10.4
12	60.0	260.15	0.660	1.36	3.31	260.38	*	128	*	*	*	64	59	10.4
13	65.0	263.81	0.840	1.74	3.73	264.12	*	127	*	*	*	62	59	10.4
14	70.0	267.47	0.840	1.73	3.72	267.84	*	128	*	*	*	63	59	10.4
15	75.0	271.23	0.860	1.77	3.77	271.60	*	129	*	*	*	63	60	10.4
16	80.0	275.02	0.870	1.79	3.79	275.39	*	129	*	*	*	64	60	10.4
17	85.0	278.81	0.880	1.81	3.81	279.21	*	130	*	*	*	64	60	10.4
18	90.0	282.61	0.900	1.86	3.86	283.06	*	129	*	*	*	65	60	10.4
19	95.0	286.40	0.870	1.80	3.80	286.86	*	129	*	*	*	65	60	10.4
20	100.0	290.21	0.850	1.76	3.75	290.62	*	129	*	*	*	65	60	10.4
21	105.0	293.97	0.810	1.67	3.67	294.28	*	129	*	*	*	66	61	10.4
22	110.0	297.52	0.780	1.62	3.60	297.89	*	129	*	*	*	66	61	10.4
23	115.0	300.77	0.670	1.39	3.35	301.23	*	128	*	*	*	65	61	10.4
24	120.0	304.03	0.660	1.37	3.32	304.55	*	128	*	*	*	65	61	10.4
End Time	0:00													
Run Time	120		Avg DH=	1.65			Avg Ts=	128.58				Avg Tm=	60.65	

Integrated Gas Sampling Data :

Bag No.	T4-R3
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0611
Nozzle No.	glass
Nozzle Dn.	0.222

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
830.8	789.5	767.7	761.9	768.4	768.3	780.7	933.7	
748.5	757.7	760.9	756.5	768.7	767.6	782.2	909.1	
82.3	31.8	6.8	5.4	-0.3	0.7	-1.5	24.6	149.8

\* Data Recorded on Field Data Sheet



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-8 Probe ID 10-3 Bar. Pres 28.18 in Hg  
Smpl Loc Furnace Line 2 SV 025 Meter Y 0.9749 Pitot No. 10-3 Stat. Pres 20.63 in H<sub>2</sub>O  
Test No. 4-Baseline Run 1 Orifice H@ 1.9256 Pitot Cp 0.87 Probe Lgth 10 ft  
Date 10-4-16 Operators DJL/MSU/JMK Liner Type: ☐ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6001

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>7</u> in Hg
Pitot (3 in.)	Pos. <u>+</u>	Neg. <u>-</u>

Sample Point	Sample Time $\Delta t$	Meter Volume Vm, ft <sup>3</sup>	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. ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		<u>42.11</u>											
A-6	5	<u>75.33</u>	<u>0.80</u>	<u>1.69</u>	<u>2.16</u>	<u>3.0</u>	<u>125</u>	<u>265</u>	<u>261</u>	<u>60</u>	<u>61</u>	<u>60</u>	
6	10	<u>49.41</u>	<u>0.82</u>	<u>1.73</u>		<u>3.0</u>	<u>126</u>	<u>267</u>	<u>265</u>	<u>56</u>	<u>61</u>	<u>60</u>	
5	15	<u>53.15</u>	<u>0.84</u>	<u>1.77</u>		<u>3.0</u>	<u>127</u>	<u>265</u>	<u>266</u>	<u>58</u>	<u>63</u>	<u>61</u>	
5	20	<u>56.90</u>	<u>0.85</u>	<u>1.79</u>		<u>3.0</u>	<u>127</u>	<u>263</u>	<u>266</u>	<u>60</u>	<u>65</u>	<u>61</u>	
4	25	<u>60.63</u>	<u>0.86</u>	<u>1.81</u>		<u>3.0</u>	<u>128</u>	<u>267</u>	<u>266</u>	<u>62</u>	<u>66</u>	<u>62</u>	
4	30	<u>64.52</u>	<u>0.91</u>	<u>1.92</u>		<u>3.5</u>	<u>128</u>	<u>264</u>	<u>264</u>	<u>63</u>	<u>68</u>	<u>63</u>	
3	35	<u>68.18</u>	<u>0.90</u>	<u>1.69</u>		<u>3.0</u>	<u>129</u>	<u>266</u>	<u>266</u>	<u>64</u>	<u>69</u>	<u>63</u>	
3	40	<u>71.80</u>	<u>0.90</u>	<u>1.69</u>		<u>3.0</u>	<u>129</u>	<u>266</u>	<u>266</u>	<u>64</u>	<u>69</u>	<u>64</u>	
2	45	<u>75.20</u>	<u>0.94</u>	<u>1.57</u>		<u>3.0</u>	<u>128</u>	<u>265</u>	<u>266</u>	<u>64</u>	<u>70</u>	<u>64</u>	
2	50	<u>78.65</u>	<u>0.95</u>	<u>1.59</u>		<u>3.0</u>	<u>128</u>	<u>265</u>	<u>266</u>	<u>64</u>	<u>70</u>	<u>65</u>	
1	55	<u>82.02</u>	<u>0.66</u>	<u>1.45</u>		<u>2.5</u>	<u>128</u>	<u>266</u>	<u>264</u>	<u>64</u>	<u>71</u>	<u>66</u>	
1	60	<u>85.30</u>	<u>0.66</u>	<u>1.47</u>		<u>2.5</u>	<u>127</u>	<u>264</u>	<u>265</u>	<u>64</u>	<u>71</u>	<u>66</u>	
B-6	65	<u>88.72</u>	<u>0.74</u>	<u>1.58</u>		<u>3.0</u>	<u>127</u>	<u>265</u>	<u>264</u>	<u>66</u>	<u>70</u>	<u>67</u>	
6	70	<u>92.27</u>	<u>0.75</u>	<u>1.60</u>		<u>3.5</u>	<u>128</u>	<u>264</u>	<u>262</u>	<u>68</u>	<u>70</u>	<u>67</u>	
5	75	<u>96.09</u>	<u>0.83</u>	<u>1.77</u>		<u>3.5</u>	<u>128</u>	<u>257</u>	<u>268</u>	<u>67</u>	<u>71</u>	<u>67</u>	
5	80	<u>99.93</u>	<u>0.84</u>	<u>1.79</u>		<u>3.5</u>	<u>129</u>	<u>254</u>	<u>255</u>	<u>67</u>	<u>72</u>	<u>68</u>	
4	85	<u>103.68</u>	<u>0.83</u>	<u>1.77</u>		<u>3.5</u>	<u>129</u>	<u>254</u>	<u>254</u>	<u>67</u>	<u>72</u>	<u>68</u>	
4	90	<u>107.68</u>	<u>0.86</u>	<u>1.83</u>		<u>3.5</u>	<u>129</u>	<u>256</u>	<u>254</u>	<u>64</u>	<u>73</u>	<u>68</u>	
3	95	<u>111.52</u>	<u>0.87</u>	<u>1.79</u>		<u>3.5</u>	<u>129</u>	<u>256</u>	<u>256</u>	<u>63</u>	<u>73</u>	<u>68</u>	
3	100	<u>115.24</u>	<u>0.80</u>	<u>1.71</u>		<u>3.5</u>	<u>129</u>	<u>256</u>	<u>253</u>	<u>63</u>	<u>73</u>	<u>69</u>	
2	105	<u>118.75</u>	<u>0.75</u>	<u>1.60</u>		<u>3.0</u>	<u>129</u>	<u>254</u>	<u>256</u>	<u>62</u>	<u>73</u>	<u>69</u>	
2	110	<u>122.30</u>	<u>0.74</u>	<u>1.58</u>		<u>3.0</u>	<u>129</u>	<u>254</u>	<u>256</u>	<u>62</u>	<u>73</u>	<u>69</u>	
1	115	<u>125.92</u>	<u>0.74</u>	<u>1.58</u>		<u>3.0</u>	<u>129</u>	<u>254</u>	<u>255</u>	<u>60</u>	<u>74</u>	<u>69</u>	
1	120	<u>129.44</u>	<u>0.74</u>	<u>1.58</u>		<u>3.0</u>	<u>129</u>	<u>254</u>	<u>255</u>	<u>60</u>	<u>73</u>	<u>69</u>	
Σ=		<u>Vm=873.7</u>	<u>0.79</u>	<u>ΔH=1.68</u>			<u>Ts=128.28</u>				<u>Tm=67.58</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>60</u>	<u>14.1</u>	<u>9.5</u>	<u>1623</u>	<u>1228</u>	<u>T4-R1</u>	<u>75</u>	<u>0</u>	<u>400609</u>	<u>51455</u>	<u>0.222</u>	<u>10-4-16</u>
Run 2												
											Avg. in.	<u>0.222</u>

Moisture Recovery Data and impinger content information: See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>197.796</u>	<u>199.818</u>





ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-8 Probe ID 10-3 Bar. Pres 28.18 in Hg  
Smpl Loc Furnace Line 2 SV 425 Meter Y 0.799 Pitot No. 10-3 Stat. Pres 25.63 in H<sub>2</sub>O  
Test No. 4-Baseline Run 2 Orifice H@ 1.9256 Pitot Cp 0.88 Probe Lgth 10 ft  
Date 10-4-16 Operators DJH/MTA/SAL/7X Liner Type: ☐ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6001

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>9</u> in Hg
Pitot (3 in.)	Pos. <input checked="" type="checkbox"/> Neg. <input checked="" type="checkbox"/>	

Sample Point	Sample Time $\Delta t$	Meter Volume Vm, ft <sup>3</sup>	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. ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		<u>129.73</u>											
A-6	5	<u>133.33</u>	<u>0.76</u>	<u>1.62</u>	<u>cfm</u>	<u>3.5</u>	<u>128</u>	<u>256</u>	<u>251</u>	<u>62</u>	<u>67</u>	<u>67</u>	
6	10	<u>136.93</u>	<u>0.75</u>	<u>1.60</u>		<u>3.5</u>	<u>127</u>	<u>254</u>	<u>255</u>	<u>55</u>	<u>67</u>	<u>67</u>	
5	15	<u>140.75</u>	<u>0.84</u>	<u>1.73</u>		<u>4.0</u>	<u>128</u>	<u>255</u>	<u>255</u>	<u>53</u>	<u>68</u>	<u>67</u>	
5	20	<u>144.50</u>	<u>0.86</u>	<u>1.83</u>		<u>4.0</u>	<u>128</u>	<u>255</u>	<u>256</u>	<u>56</u>	<u>69</u>	<u>67</u>	
4	25	<u>147.36</u>	<u>0.86</u>	<u>1.83</u>		<u>4.0</u>	<u>128</u>	<u>254</u>	<u>286</u>	<u>58</u>	<u>69</u>	<u>67</u>	
4	30	<u>152.21</u>	<u>0.86</u>	<u>1.83</u>		<u>4.0</u>	<u>128</u>	<u>251</u>	<u>255</u>	<u>58</u>	<u>70</u>	<u>67</u>	
3	35	<u>156.03</u>	<u>0.81</u>	<u>1.73</u>		<u>4.0</u>	<u>128</u>	<u>255</u>	<u>257</u>	<u>60</u>	<u>70</u>	<u>67</u>	
3	40	<u>159.71</u>	<u>0.81</u>	<u>1.73</u>		<u>4.0</u>	<u>128</u>	<u>254</u>	<u>257</u>	<u>63</u>	<u>71</u>	<u>67</u>	
2	45	<u>163.41</u>	<u>0.78</u>	<u>1.66</u>		<u>3.5</u>	<u>128</u>	<u>254</u>	<u>257</u>	<u>64</u>	<u>71</u>	<u>67</u>	
2	50	<u>166.92</u>	<u>0.75</u>	<u>1.60</u>		<u>3.5</u>	<u>129</u>	<u>255</u>	<u>256</u>	<u>64</u>	<u>71</u>	<u>68</u>	
1	55	<u>170.31</u>	<u>0.69</u>	<u>1.47</u>		<u>3.5</u>	<u>128</u>	<u>255</u>	<u>255</u>	<u>64</u>	<u>71</u>	<u>68</u>	
1	60	<u>173.67</u>	<u>0.69</u>	<u>1.47</u>		<u>3.5</u>	<u>128</u>	<u>254</u>	<u>255</u>	<u>64</u>	<u>72</u>	<u>68</u>	
B-6	65	<u>177.00</u>	<u>0.83</u>	<u>1.77</u>		<u>4.0</u>	<u>128</u>	<u>256</u>	<u>257</u>	<u>66</u>	<u>70</u>	<u>68</u>	
6	70	<u>181.22</u>	<u>0.86</u>	<u>1.83</u>		<u>4.0</u>	<u>128</u>	<u>256</u>	<u>257</u>	<u>65</u>	<u>70</u>	<u>68</u>	
5	75	<u>185.00</u>	<u>0.85</u>	<u>1.81</u>		<u>4.0</u>	<u>128</u>	<u>254</u>	<u>255</u>	<u>65</u>	<u>72</u>	<u>68</u>	
5	80	<u>188.77</u>	<u>0.84</u>	<u>1.79</u>		<u>4.0</u>	<u>128</u>	<u>255</u>	<u>256</u>	<u>64</u>	<u>73</u>	<u>69</u>	
4	85	<u>192.62</u>	<u>0.86</u>	<u>1.84</u>		<u>4.0</u>	<u>129</u>	<u>256</u>	<u>255</u>	<u>63</u>	<u>74</u>	<u>69</u>	
4	90	<u>196.40</u>	<u>0.85</u>	<u>1.72</u>		<u>4.0</u>	<u>129</u>	<u>253</u>	<u>256</u>	<u>63</u>	<u>74</u>	<u>70</u>	
3	95	<u>200.06</u>	<u>0.78</u>	<u>1.67</u>		<u>4.0</u>	<u>130</u>	<u>253</u>	<u>257</u>	<u>63</u>	<u>75</u>	<u>71</u>	
3	100	<u>203.63</u>	<u>0.80</u>	<u>1.72</u>		<u>4.0</u>	<u>129</u>	<u>251</u>	<u>250</u>	<u>63</u>	<u>75</u>	<u>71</u>	
2	105	<u>207.14</u>	<u>0.73</u>	<u>1.57</u>		<u>3.5</u>	<u>129</u>	<u>257</u>	<u>255</u>	<u>63</u>	<u>76</u>	<u>72</u>	
2	110	<u>210.67</u>	<u>0.74</u>	<u>1.59</u>		<u>4.0</u>	<u>129</u>	<u>254</u>	<u>253</u>	<u>63</u>	<u>76</u>	<u>72</u>	
1	115	<u>213.92</u>	<u>0.64</u>	<u>1.38</u>		<u>3.5</u>	<u>129</u>	<u>257</u>	<u>256</u>	<u>63</u>	<u>77</u>	<u>73</u>	
1	120	<u>217.18</u>	<u>0.63</u>	<u>1.36</u>		<u>3.5</u>	<u>129</u>	<u>256</u>	<u>255</u>	<u>64</u>	<u>77</u>	<u>73</u>	
Σ=		Vm= <u>87.45</u>	<u>0.79</u>	ΔH= <u>1.68</u>			Ts= <u>128.35</u>					Tm= <u>70.83</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 *	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date								
														Nozzle No.							
Run 1	0.68	10.1	9.5	1256	1503	FU-RL	15	0	90610	91051	0.222	1	See R1								
Run 2												2									
														3							
														Avg. in.							

Moisture Recovery Data and impinger content information: See impinger recovery datasheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>197.321</u>	<u>149.138</u>



0  
ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-8 Probe ID 10.3 Bar. Pres 27.92 in Hg  
Smpl Loc Furnace Line 2 SV 025 D Meter Y 0.9399 Pitot No. 10.3 Stat. Pres 26.3 in H<sub>2</sub>O  
Test No. 4-0456 Line Run 3 Orifice H@ 1.4256 Pitot Cp 0.87 Probe Lgth 10 ft  
Date 10-5-16 Operators DJK/MSW/JAE/2/17 Liner Type: ☒ Glass ☐ S.S. ☐ Other Imp TC 6001

Sample Train Leak Rate (cfm)		
Pretest	0.0	at 10 in Hg
Posttest	0.0	at 6 in Hg
Pitot (3 in.)	Pos. <input checked="" type="checkbox"/> Neg. <input 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. TS, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		217.39											
A-6	5	220.88	0.75	1.54	3.1	3.0	127	254	250	59	56	56	
6	10	224.38	0.75	1.54	2.8	3.0	127	256	253	58	56	56	
5	15	228.02	0.84	1.72		3.5	128	256	256	57	57	56	
5	20	231.89	0.87	1.78		3.5	128	255	257	59	58	57	
4	25	235.70	0.84	1.80		3.0	124	256	255	60	60	57	
4	30	239.34	0.87	1.78		3.0	124	255	256	61	61	57	
3	35	242.88	0.81	1.66		3.0	130	257	256	62	62	58	
3	40	246.70	0.84	1.73		3.0	124	256	257	62	62	58	
2	45	250.53	0.72	1.48		3.5	124	256	257	63	63	58	
2	50	253.67	0.77	1.58		3.0	124	254	255	63	63	54	
1	55	256.91	0.68	1.40		2.5	124	255	255	64	64	59	
1	60	260.15	0.66	1.36		2.5	128	256	256	64	64	59	
B-6	65	263.81	0.84	1.74		3.0	127	255	256	62	62	59	
6	70	267.47	0.84	1.73		3.0	128	255	255	58	63	59	
5	75	271.23	0.86	1.77		3.0	129	254	256	59	63	60	
5	80	275.02	0.87	1.79		3.0	129	255	255	57	64	60	
4	85	278.81	0.88	1.81		3.5	130	255	250	57	64	60	
4	90	282.61	0.90	1.86		3.5	129	255	254	58	65	60	
3	95	286.40	0.87	1.80		3.5	129	252	257	59	65	60	
3	100	290.21	0.85	1.76		3.5	124	254	254	61	65	60	
2	105	293.97	0.81	1.67		3.0	124	254	256	61	66	61	
2	110	297.52	0.78	1.61		3.0	124	255	254	62	66	61	
1	115	300.77	0.67	1.39		2.5	128	254	256	62	65	61	
1	120	304.03	0.66	1.37		2.5	128	254	254	62	65	61	
	Σ=	Vm= 36.64	0.80	ΔH= 1.65			Ts=128.58					Tm= 63.5	

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
56	19.1	10.4	0945	0950	19-123	15	0	400608	9145	0.222	1	See R1
Run 2											2	
											3	
											Avg. in.	

Moisture Recovery Data and impinger content information:

See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt, g									
Initial wt, g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
147,523	147,138

DAH 199,406

153,247



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
IMPINGER RECOVERY

Project HTC BASELINE Date 10/04/16  
Project No. 23691428.63 BASE 200 Operators TYL  
Source SV025-D Test 4 Sample Location STACK

TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START. <u>1023</u>	<u>799.7</u>	<u>752.3</u>	<u>764.3</u>	<u>760.5</u>	<u>750.2</u>	<u>754.8</u>	<u>778.0</u>	<u>985.1</u>
END	<u>934.6</u>	<u>783.8</u>	<u>771.1</u>	<u>765.0</u>	<u>749.7</u>	<u>756.7</u>	<u>777.8</u>	<u>1003.4</u>
CHANGE	<u>134.9</u>	<u>31.5</u>	<u>6.8</u>	<u>4.5</u>	<u>-0.5</u>	<u>1.9</u>	<u>-0.2</u>	<u>18.3</u>
MASS OF MOISTURE COLLECTED, g								<u>197.2</u>

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	<u>751.3</u>	<u>758.3</u>	<u>761.0</u>	<u>753.7</u>	<u>759.9</u>	<u>762.4</u>	<u>777.4</u>	<u>953.8</u>
END	<u>859.1</u>	<u>804.4</u>	<u>772.9</u>	<u>761.6</u>	<u>761.1</u>	<u>763.7</u>	<u>776.8</u>	<u>978.3</u>
CHANGE	<u>107.8</u>	<u>46.1</u>	<u>11.3</u>	<u>7.9</u>	<u>1.2</u>	<u>1.3</u>	<u>-0.6</u>	<u>24.5</u>
MASS OF MOISTURE COLLECTED, g								<u>199.5</u>

10/05/16

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	<u>748.5</u>	<u>757.7</u>	<u>760.9</u>	<u>756.5</u>	<u>768.7</u>	<u>767.6</u>	<u>782.2</u>	<u>909.1</u>
END	<u>830.8</u>	<u>789.5</u>	<u>767.7</u>	<u>761.9</u>	<u>768.4</u>	<u>768.3</u>	<u>780.7</u>	<u>933.7</u>
CHANGE	<u>82.3</u>	<u>31.8</u>	<u>6.8</u>	<u>5.4</u>	<u>-0.3</u>	<u>0.7</u>	<u>-1.5</u>	<u>24.6</u>
MASS OF MOISTURE COLLECTED, g								<u>199.8</u>

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

COMMENTS
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## EPA METHOD 2 FIELD DATA SHEET



## EPA METHOD 5 - FIELD DATA SHEET - RUN 1

Project	Hibbing Taconite Company	Meter ID	C-8	Probe ID	10-3	Bar.Press.	28.33	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 3 SV026	Meter Y	0.9799	Pitot Tube No.	10-3	Stat Press.	-0.7	in. H2O	Pretest 0.000 at 10 in. Hg
Date	10/03/16	Orifice dH@	1.9256	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 7 in. Hg
Test	3 - Baseline Run # 1			Liner Type:	Glass	IMP Out TC	6001		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	0:00	776.06												
1	5.0	779.48	0.680	1.45	3.37	779.43	*	121	*	*	*	57	56	8.4
2	10.0	782.80	0.680	1.46	3.39	782.81	*	120	*	*	*	59	58	8.4
3	15.0	786.28	0.790	1.71	3.66	786.47	*	120	*	*	*	61	59	8.4
4	20.0	789.89	0.800	1.73	3.70	790.17	*	120	*	*	*	63	59	8.4
5	25.0	793.68	0.840	1.82	3.79	793.96	*	121	*	*	*	64	60	8.4
6	30.0	797.38	0.830	1.81	3.78	797.74	*	120	*	*	*	66	61	8.4
7	35.0	801.18	0.850	1.85	3.83	801.57	*	121	*	*	*	68	62	8.4
8	40.0	804.95	0.830	1.82	3.80	805.37	*	120	*	*	*	73	72	8.4
9	45.0	808.81	0.770	1.71	3.71	809.08	*	120	*	*	*	74	73	8.4
10	50.0	812.51	0.750	1.67	3.67	812.75	*	120	*	*	*	75	73	8.4
11	55.0	816.01	0.680	1.51	3.50	816.25	*	120	*	*	*	76	73	8.4
12	60.0	819.38	0.670	1.49	3.48	819.73	*	120	*	*	*	77	74	8.4
13	65.0	822.84	0.710	1.58	3.58	823.31	*	121	*	*	*	78	75	8.4
14	70.0	826.41	0.710	1.58	3.59	826.90	*	121	*	*	*	78	75	8.4
15	75.0	830.02	0.740	1.65	3.66	830.57	*	121	*	*	*	78	75	8.4
16	80.0	833.80	0.760	1.70	3.71	834.28	*	121	*	*	*	78	75	8.4
17	85.0	837.44	0.760	1.70	3.71	837.99	*	121	*	*	*	80	76	8.4
18	90.0	841.30	0.780	1.75	3.77	841.76	*	121	*	*	*	80	76	8.4
19	95.0	845.10	0.830	1.86	3.89	845.65	*	121	*	*	*	81	77	8.4
20	100.0	849.00	0.830	1.86	3.90	849.55	*	121	*	*	*	81	77	8.4
21	105.0	852.76	0.810	1.82	3.85	853.40	*	120	*	*	*	82	77	8.4
22	110.0	856.57	0.790	1.77	3.81	857.21	*	121	*	*	*	82	78	8.4
23	115.0	860.26	0.750	1.68	3.71	860.92	*	121	*	*	*	83	78	8.4
24	120.0	863.95	0.710	1.60	3.62	864.54	*	121	*	*	*	83	79	8.4
End Time	0:00													
Run Time	120		Avg DH=	1.69			Avg Ts=	120.58				Avg Tm=	72.40	

Integrated Gas Sampling Data :

Bag No.	T3-R1
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0603
Nozzle No.	glass
Nozzle Dn.	0.222

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
900.9	777.4	769.7	763.2	748.2	758.3	775.4	983.6	
797.7	750.9	763.1	760.4	748.8	757.3	774.9	960.6	
103.2	26.5	6.6	2.8	-0.6	1	0.5	23	163

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 2

Project	Hibbing Taconite Company	Meter ID	C-8	Probe ID	10-3	Bar.Press.	28.33	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 3 SV026	Meter Y	0.9799	Pitot Tube No.	10-3	Stat Press.	-0.7	in. H2O	Pretest 0.000 at 10 in. Hg
Date	10/03/16	Orifice dH@	1.9256	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 6 in. Hg
Test	3 - Baseline Run # 2			Liner Type:	Glass	IMP Out TC	6001		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	0:00	864.30												
1	5.0	867.78	0.700	1.57	3.58	867.88	*	120	*	*	*	79	80	8.4
2	10.0	871.38	0.670	1.50	3.51	871.39	*	121	*	*	*	80	81	8.4
3	15.0	875.01	0.780	1.75	3.79	875.18	*	122	*	*	*	81	81	8.4
4	20.0	878.64	0.740	1.66	3.69	878.87	*	122	*	*	*	83	82	8.4
5	25.0	882.38	0.810	1.82	3.87	882.74	*	122	*	*	*	84	82	8.4
6	30.0	886.27	0.830	1.87	3.92	886.66	*	122	*	*	*	85	83	8.4
7	35.0	890.27	0.860	1.94	4.00	890.66	*	122	*	*	*	86	84	8.4
8	40.0	894.31	0.890	2.01	4.07	894.74	*	122	*	*	*	87	84	8.4
9	45.0	898.15	0.830	1.88	3.94	898.68	*	121	*	*	*	88	85	8.4
10	50.0	902.18	0.850	1.93	3.99	902.67	*	122	*	*	*	88	85	8.4
11	55.0	905.75	0.740	1.68	3.73	906.41	*	121	*	*	*	88	86	8.4
12	60.0	909.44	0.720	1.64	3.69	910.09	*	121	*	*	*	88	86	8.4
13	65.0	913.08	0.670	1.52	3.55	913.64	*	122	*	*	*	87	88	8.4
14	70.0	916.60	0.670	1.53	3.56	917.20	*	121	*	*	*	87	87	8.4
15	75.0	920.22	0.740	1.68	3.73	920.94	*	122	*	*	*	87	87	8.4
16	80.0	924.00	0.720	1.64	3.68	924.62	*	122	*	*	*	87	87	8.4
17	85.0	927.76	0.780	1.77	3.83	928.45	*	123	*	*	*	87	87	8.4
18	90.0	931.52	0.780	1.77	3.83	932.28	*	122	*	*	*	87	86	8.4
19	95.0	935.42	0.830	1.88	3.95	936.22	*	122	*	*	*	86	86	8.4
20	100.0	939.37	0.830	1.88	3.94	940.17	*	122	*	*	*	86	86	8.4
21	105.0	943.10	0.790	1.79	3.85	944.02	*	122	*	*	*	86	86	8.4
22	110.0	947.05	0.820	1.86	3.92	947.94	*	122	*	*	*	86	86	8.4
23	115.0	950.40	0.660	1.50	3.52	951.46	*	122	*	*	*	85	85	8.4
24	120.0	954.06	0.660	1.49	3.51	954.97	*	122	*	*	*	85	85	8.4
End Time	0:00													
Run Time	120		Avg DH=	1.73			Avg Ts=	121.75				Avg Tm=	85.17	

Integrated Gas Sampling Data :

Bag No.	T3-R2
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0604
Nozzle No.	glass
Nozzle Dn.	0.222

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
849.8	790.7	769.5	765.1	759.6	739.0	804.0	953.5	
761.9	754.6	759.9	758.7	759.1	738.9	804.1	931.9	
87.9	36.1	9.6	6.4	0.5	0.1	-0.1	21.6	162.1

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 3

Project	Hibbing Taconite Company	Meter ID	C-8	Probe ID	10-3	Bar.Press.	28.18	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 3 SV026	Meter Y	0.9799	Pitot Tube No.	10-3	Stat Press.	-0.7	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/04/16	Orifice dH@	1.9256	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 6 in. Hg
Test	3 - Baseline Run # 3			Liner Type:	Glass	IMP Out TC	6001		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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	954.20												
1	5.0	957.58	0.680	1.44	3.35	957.55	*	120	*	*	*	50	50	8.6
2	10.0	960.88	0.660	1.40	3.30	960.84	*	120	*	*	*	51	50	8.6
3	15.0	964.48	0.770	1.63	3.56	964.40	*	121	*	*	*	52	51	8.6
4	20.0	967.95	0.760	1.61	3.54	967.94	*	122	*	*	*	53	51	8.6
5	25.0	971.70	0.830	1.76	3.70	971.64	*	122	*	*	*	54	51	8.6
6	30.0	975.28	0.830	1.76	3.71	975.35	*	121	*	*	*	56	52	8.6
7	35.0	979.12	0.880	1.87	3.83	979.18	*	121	*	*	*	57	52	8.6
8	40.0	983.00	0.870	1.85	3.81	982.99	*	122	*	*	*	57	53	8.6
9	45.0	986.73	0.850	1.81	3.77	986.76	*	121	*	*	*	58	53	8.6
10	50.0	990.62	0.850	1.82	3.77	990.54	*	121	*	*	*	59	53	8.6
11	55.0	994.15	0.760	1.63	3.57	994.11	*	121	*	*	*	59	54	8.6
12	60.0	997.54	0.740	1.58	3.53	997.64	*	122	*	*	*	60	54	8.6
13	65.0	1000.78	0.720	1.54	3.49	1001.12	*	121	*	*	*	58	55	8.6
14	70.0	1004.22	0.740	1.58	3.53	1004.65	*	121	*	*	*	58	55	8.6
15	75.0	1007.80	0.780	1.67	3.62	1008.28	*	122	*	*	*	59	55	8.6
16	80.0	1011.32	0.780	1.67	3.63	1011.90	*	121	*	*	*	60	56	8.6
17	85.0	1015.17	0.840	1.80	3.77	1015.67	*	122	*	*	*	61	56	8.6
18	90.0	1019.04	0.930	2.00	3.97	1019.64	*	121	*	*	*	61	56	8.6
19	95.0	1023.03	0.890	1.91	3.88	1023.52	*	121	*	*	*	62	57	8.6
20	100.0	1027.00	0.900	1.94	3.91	1027.44	*	121	*	*	*	62	57	8.6
21	105.0	1030.72	0.830	1.79	3.76	1031.20	*	120	*	*	*	63	58	8.6
22	110.0	1034.62	0.850	1.83	3.81	1035.01	*	121	*	*	*	63	58	8.6
23	115.0	1038.21	0.790	1.71	3.68	1038.69	*	120	*	*	*	63	58	8.6
24	120.0	1041.86	0.790	1.71	3.68	1042.37	*	120	*	*	*	64	58	8.6
End Time	0:00													
Run Time	120		Avg DH=	1.72			Avg Ts=	121.04				Avg Tm=	56.31	

## Integrated Gas Sampling Data :

Bag No. T3-R3  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0605  
Nozzle No. glass  
Nozzle Dn. 0.222

## MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
886.2	785.0	771.4	765.6	768.9	758.8	818.3	968.7	
766.8	758.8	765.9	762.3	768.8	758.8	818.1	953.3	
119.4	26.2	5.5	3.3	0.1	0	0.2	15.4	170.1

\* Data Recorded on Field Data Sheet



ONTARIO HYDRO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-8 Probe ID 10-3 Bar. Pres 28.33 in Hg  
Smpl Loc Furnace Line 2 SV 026 Meter Y 0.9799 Pitot No. 10-3 Stat. Pres 28.65 in H<sub>2</sub>O  
Test No. 3-Baseline Run 1 Orifice H@ 1.9256 Pitot Cp 0.34 Probe Lgth 10 ft  
Date 10-3-16 Operators ASK, MSA, SARZ Liner Type: ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6001  
Sample Train Leak Rate (cfm)  
Pretest 0.0 at 10 in Hg  
Posttest 0.0 at 7 in Hg  
Pitot (3 in.) Pos. 2 Neg. 4

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. Ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		<u>776.06</u>											
A-6	5	<u>779.48</u>	<u>0.68</u>	<u>1.45</u>	<u>2612</u>	<u>3.5</u>	<u>121</u>	<u>248</u>	<u>251</u>	<u>50</u>	<u>57</u>	<u>56</u>	
6	10	<u>782.80</u>	<u>0.68</u>	<u>1.46</u>		<u>3.5</u>	<u>120</u>	<u>248</u>	<u>252</u>	<u>49</u>	<u>59</u>	<u>58</u>	
5	15	<u>786.23</u>	<u>0.79</u>	<u>1.71</u>		<u>4.0</u>	<u>120</u>	<u>248</u>	<u>252</u>	<u>46</u>	<u>61</u>	<u>59</u>	
5	20	<u>789.89</u>	<u>0.80</u>	<u>1.73</u>		<u>4.0</u>	<u>120</u>	<u>248</u>	<u>249</u>	<u>46</u>	<u>63</u>	<u>59</u>	
4	25	<u>793.63</u>	<u>0.84</u>	<u>1.82</u>		<u>4.0</u>	<u>121</u>	<u>248</u>	<u>251</u>	<u>47</u>	<u>64</u>	<u>60</u>	
4	30	<u>797.34</u>	<u>0.87</u>	<u>1.81</u>		<u>4.0</u>	<u>120</u>	<u>249</u>	<u>252</u>	<u>47</u>	<u>66</u>	<u>61</u>	
3	35	<u>801.14</u>	<u>0.85</u>	<u>1.85</u>		<u>4.5</u>	<u>121</u>	<u>249</u>	<u>254</u>	<u>47</u>	<u>68</u>	<u>62</u>	
3	40	<u>804.95</u>	<u>0.83</u>	<u>1.82</u>		<u>4.5</u>	<u>120</u>	<u>264</u>	<u>265</u>	<u>54</u>	<u>73</u>	<u>72</u>	
2	45	<u>808.81</u>	<u>0.77</u>	<u>1.71</u>		<u>4.0</u>	<u>120</u>	<u>265</u>	<u>266</u>	<u>54</u>	<u>74</u>	<u>73</u>	
2	50	<u>812.51</u>	<u>0.75</u>	<u>1.67</u>		<u>4.0</u>	<u>120</u>	<u>261</u>	<u>264</u>	<u>56</u>	<u>75</u>	<u>73</u>	
1	55	<u>816.01</u>	<u>0.68</u>	<u>1.51</u>		<u>3.5</u>	<u>120</u>	<u>267</u>	<u>262</u>	<u>59</u>	<u>76</u>	<u>73</u>	
1	60	<u>819.35</u>	<u>0.67</u>	<u>1.49</u>		<u>3.5</u>	<u>120</u>	<u>263</u>	<u>261</u>	<u>60</u>	<u>77</u>	<u>74</u>	
B-6	65	<u>822.84</u>	<u>0.71</u>	<u>1.58</u>		<u>4.0</u>	<u>121</u>	<u>262</u>	<u>260</u>	<u>65</u>	<u>78</u>	<u>75</u>	
6	70	<u>826.41</u>	<u>0.71</u>	<u>1.58</u>		<u>4.0</u>	<u>121</u>	<u>258</u>	<u>261</u>	<u>65</u>	<u>78</u>	<u>75</u>	
5	75	<u>830.02</u>	<u>0.74</u>	<u>1.65</u>		<u>4.0</u>	<u>121</u>	<u>264</u>	<u>260</u>	<u>63</u>	<u>78</u>	<u>75</u>	
5	80	<u>833.80</u>	<u>0.72</u>	<u>1.70</u>		<u>4.0</u>	<u>121</u>	<u>261</u>	<u>262</u>	<u>62</u>	<u>78</u>	<u>75</u>	
4	85	<u>837.44</u>	<u>0.72</u>	<u>1.70</u>		<u>4.0</u>	<u>121</u>	<u>257</u>	<u>263</u>	<u>62</u>	<u>80</u>	<u>76</u>	
4	90	<u>841.30</u>	<u>0.70</u>	<u>1.75</u>		<u>4.5</u>	<u>121</u>	<u>258</u>	<u>266</u>	<u>62</u>	<u>80</u>	<u>76</u>	
3	95	<u>845.10</u>	<u>0.83</u>	<u>1.86</u>		<u>4.5</u>	<u>121</u>	<u>258</u>	<u>265</u>	<u>62</u>	<u>81</u>	<u>77</u>	
3	100	<u>849.00</u>	<u>0.83</u>	<u>1.86</u>		<u>4.5</u>	<u>121</u>	<u>258</u>	<u>266</u>	<u>62</u>	<u>81</u>	<u>77</u>	
2	105	<u>852.76</u>	<u>0.81</u>	<u>1.82</u>		<u>4.5</u>	<u>120</u>	<u>259</u>	<u>265</u>	<u>62</u>	<u>82</u>	<u>77</u>	
2	110	<u>856.57</u>	<u>0.79</u>	<u>1.77</u>		<u>4.5</u>	<u>121</u>	<u>257</u>	<u>263</u>	<u>62</u>	<u>82</u>	<u>78</u>	
1	115	<u>860.26</u>	<u>0.75</u>	<u>1.68</u>		<u>4.5</u>	<u>121</u>	<u>258</u>	<u>261</u>	<u>63</u>	<u>83</u>	<u>78</u>	
1	120	<u>863.95</u>	<u>0.71</u>	<u>1.60</u>		<u>4.0</u>	<u>121</u>	<u>259</u>	<u>260</u>	<u>63</u>	<u>83</u>	<u>79</u>	
Σ=		<u>Vm=87.89</u>	<u>0.76</u>	<u>ΔH=1.69</u>			<u>Ts=120.58</u>				<u>Tm=72.40</u>		

											Nozzle Calibration		
Initialization Values				Test Run Times		ORSAT System			Sample Train Components			Tech. <u>DJK</u>	Date <u>10-3-16</u>
	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	Nozzle No.	
Run 1	<u>57</u>	<u>195</u>	<u>8.7</u>	<u>1035</u>	<u>1415</u>	<u>13-R1</u>	<u>65</u>	<u>0</u>	<u>440603</u>	<u>9455</u>	<u>0.222</u>	1	<u>0.222</u>
Run 2												2	<u>0.222</u>
												3	<u>0.222</u>
												Avg. in.	<u>0.222</u>

Moisture Recovery Data and Impinger content information:

*See impinger recovery data sheet*

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>192.225</u>	<u>150.977</u>





ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-8 Probe ID 10-3 Bar. Pres 28.33 in Hg  
Smpl Loc Furnace Line 2 SV 026 C Meter Y 0.9794 Pitot No. 10-3 Stat. Pres 20.65 in H<sub>2</sub>O  
Test No. 3-Baseline Run 2 Orifice H@ 1.9256 Pitot Cp 0.44 Probe Lgth 10.25 ft  
Date 10-3-16 Operators DSC, MVA, JAL Liner Type: ☐ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6001

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>6</u> in Hg
Pitot (3 in.)	Pos. <input checked="" type="checkbox"/> Neg. <input 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. Ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		<u>864.30</u>											
A-6	5	<u>867.78</u>	<u>0.70</u>	<u>1.57</u>	<u>2616</u>	<u>3.0</u>	<u>120</u>	<u>252</u>	<u>252</u>	<u>64</u>	<u>79</u>	<u>80</u>	
6	10	<u>871.38</u>	<u>0.67</u>	<u>1.50</u>		<u>3.0</u>	<u>121</u>	<u>254</u>	<u>265</u>	<u>62</u>	<u>80</u>	<u>81</u>	
5	15	<u>875.01</u>	<u>0.78</u>	<u>1.75</u>		<u>3.0</u>	<u>122</u>	<u>254</u>	<u>265</u>	<u>61</u>	<u>81</u>	<u>81</u>	
5	20	<u>878.64</u>	<u>0.74</u>	<u>1.66</u>		<u>3.0</u>	<u>122</u>	<u>254</u>	<u>265</u>	<u>62</u>	<u>83</u>	<u>82</u>	
4	25	<u>882.38</u>	<u>0.81</u>	<u>1.82</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>265</u>	<u>62</u>	<u>84</u>	<u>82</u>	
4	30	<u>886.27</u>	<u>0.83</u>	<u>1.87</u>		<u>3.5</u>	<u>123</u>	<u>258</u>	<u>266</u>	<u>63</u>	<u>85</u>	<u>83</u>	
3	35	<u>890.27</u>	<u>0.86</u>	<u>1.97</u>		<u>3.5</u>	<u>122</u>	<u>257</u>	<u>264</u>	<u>62</u>	<u>86</u>	<u>84</u>	
3	40	<u>894.31</u>	<u>0.89</u>	<u>2.01</u>		<u>3.5</u>	<u>122</u>	<u>257</u>	<u>265</u>	<u>62</u>	<u>87</u>	<u>84</u>	
2	45	<u>898.15</u>	<u>0.83</u>	<u>1.84</u>		<u>3.5</u>	<u>121</u>	<u>254</u>	<u>266</u>	<u>61</u>	<u>88</u>	<u>85</u>	
2	50	<u>902.18</u>	<u>0.85</u>	<u>1.93</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>266</u>	<u>62</u>	<u>88</u>	<u>85</u>	
1	55	<u>905.75</u>	<u>0.74</u>	<u>1.68</u>		<u>3.0</u>	<u>121</u>	<u>257</u>	<u>264</u>	<u>62</u>	<u>88</u>	<u>86</u>	
1	60	<u>909.44</u>	<u>0.72</u>	<u>1.67</u>		<u>3.0</u>	<u>121</u>	<u>258</u>	<u>265</u>	<u>62</u>	<u>88</u>	<u>86</u>	
B-6	65	<u>913.08</u>	<u>0.67</u>	<u>1.52</u>		<u>3.0</u>	<u>122</u>	<u>253</u>	<u>265</u>	<u>66</u>	<u>87</u>	<u>88</u>	
6	70	<u>916.60</u>	<u>0.67</u>	<u>1.53</u>		<u>3.0</u>	<u>121</u>	<u>257</u>	<u>261</u>	<u>63</u>	<u>87</u>	<u>87</u>	
5	75	<u>920.22</u>	<u>0.74</u>	<u>1.68</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>265</u>	<u>62</u>	<u>87</u>	<u>87</u>	
5	80	<u>924.60</u>	<u>0.72</u>	<u>1.64</u>		<u>3.5</u>	<u>122</u>	<u>257</u>	<u>264</u>	<u>62</u>	<u>87</u>	<u>87</u>	
4	85	<u>927.76</u>	<u>0.78</u>	<u>1.77</u>		<u>3.5</u>	<u>123</u>	<u>257</u>	<u>264</u>	<u>62</u>	<u>87</u>	<u>87</u>	
4	90	<u>931.52</u>	<u>0.78</u>	<u>1.77</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>265</u>	<u>62</u>	<u>87</u>	<u>86</u>	
3	95	<u>935.42</u>	<u>0.83</u>	<u>1.88</u>		<u>3.5</u>	<u>122</u>	<u>257</u>	<u>263</u>	<u>62</u>	<u>86</u>	<u>86</u>	
3	100	<u>939.37</u>	<u>0.83</u>	<u>1.88</u>		<u>3.5</u>	<u>122</u>	<u>258</u>	<u>265</u>	<u>62</u>	<u>86</u>	<u>86</u>	
2	105	<u>943.10</u>	<u>0.79</u>	<u>1.79</u>		<u>3.5</u>	<u>122</u>	<u>258</u>	<u>267</u>	<u>62</u>	<u>86</u>	<u>86</u>	
2	110	<u>947.05</u>	<u>0.82</u>	<u>1.86</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>262</u>	<u>62</u>	<u>86</u>	<u>86</u>	
1	115	<u>950.40</u>	<u>0.66</u>	<u>1.50</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>263</u>	<u>62</u>	<u>85</u>	<u>85</u>	
1	120	<u>954.06</u>	<u>0.66</u>	<u>1.49</u>		<u>3.5</u>	<u>122</u>	<u>254</u>	<u>266</u>	<u>62</u>	<u>85</u>	<u>85</u>	
Σ		<u>Vm=89.76</u>	<u>0.77</u>	<u>ΔH=1.73</u>			<u>Ts=121.35</u>					<u>Tm=85.17</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>79</u>	<u>19.5</u>	<u>8.7</u>	<u>15:15</u>	<u>17:12</u>	<u>T3-R2</u>	<u>150</u>	<u>0</u>	<u>400604</u>	<u>91455</u>	<u>0.222</u>	<u>1</u>	<u>See R1</u>
Run 2											<u>2</u>	
											<u>3</u>	
											Avg. in.	

Moisture Recovery Data and impinger content information:

See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>142.447</u>	<u>150.837</u>



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-3 Probe ID 10-3 Bar. Pres 28.18 in Hg  
Smpl Loc Furnace Line 2 SV 626 Meter Y 0.9799 Pitot No. 10-3 Stat. Pres 20.65 in H<sub>2</sub>O  
Test No. 3-Baseline Run 3 Orifice H@ 1.9256 Pitot Cp 0.84 Probe Lgth 10 ft  
Date 10-9-16 Operators DJCLMSN/JALZ Liner Type: ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6001

Sample Train Leak Rate (cfm)		
Pretest	0.0	at 10 in Hg
Posttest	0.0	at 6 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. Ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		954.20											
A-6	5	957.58	0.68	1.44	c file	3.0	120	268	255	44	50	50	
6	10	960.88	0.66	1.40		2.5	120	265	261	40	51	50	
5	15	964.48	0.72	1.63		3.0	121	265	268	40	52	51	
5	20	967.95	0.76	1.61		3.0	122	265	266	41	53	51	
4	25	971.70	0.83	1.76		3.0	122	266	268	41	54	51	
4	30	975.23	0.83	1.76		3.0	121	265	267	42	56	52	
3	35	979.12	0.88	1.87		3.0	121	264	267	42	57	52	
3	40	983.00	0.87	1.85		3.0	122	262	266	42	57	53	
2	45	986.73	0.85	1.81		3.0	121	265	266	43	58	53	
2	50	990.62	0.85	1.82		3.0	121	264	264	43	59	53	
1	55	994.15	0.76	1.63		3.0	121	264	265	45	59	54	
1	60	997.57	0.74	1.58		2.5	122	265	265	45	60	54	
B-6	65	1000.78	0.72	1.54		2.5	121	266	264	47	58	55	
6	70	1004.22	0.74	1.58		2.5	121	266	265	46	58	55	
5	75	1007.50	0.78	1.67		3.0	122	265	268	46	59	55	
5	80	1011.32	0.78	1.67		3.0	121	265	265	48	60	56	
4	85	1015.17	0.87	1.80		3.0	122	264	265	50	61	56	
4	90	1019.04	0.93	2.00		3.5	121	267	265	52	61	56	
3	95	1023.03	0.89	1.91		3.5	121	268	266	54	62	57	
3	100	1027.00	0.90	1.94		3.5	121	264	265	56	62	57	
2	105	1030.72	0.83	1.79		3.0	120	267	265	58	63	58	
2	110	1034.62	0.85	1.83		3.0	121	263	261	54	63	58	
1	115	1038.21	0.79	1.71		3.0	120	264	267	60	63	58	
1	120	1041.86	0.74	1.71		2.0	120	265	266	61	64	58	
Σ=		Vm=97.46	0.81	ΔH=1.72			Ts=121.04					Tm=56.31	

Initialization Values										Nozzle Calibration		
Test Run Times			ORSAT System			Sample Train Components			Tech. Date		Nozzle No.	
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	1	2
50	19.5	8.0	1046	0953	13-123	15	0	400605	9455	0.222	See 101	
Run 1											3	
Run 2											Avg. in.	

Moisture Recovery Data and impinger content information: See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
197,860	154,191



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
IMPINGER RECOVERY

Project HTC BASELINE Date 10/03/2016  
Project No. 23691428.63 BASE 200 Operators TYL  
Source ~~S1028-A~~ S1026-C Sample Location STACK

TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	797.7	750.9	763.1	760.4	748.8	757.3	774.9	960.6
END	900.9	777.4	769.7	763.2	748.2	758.3	775.4	983.6
CHANGE	103.2	26.5	6.6	2.8	-0.6	1.0	0.5	23.0
MASS OF MOISTURE COLLECTED, g								163.0

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START. 1905	761.9	754.6	759.9	758.7	759.1	738.9	804.1	931.9
END	849.8	790.7	769.5	765.1	759.6	739.0	804.0	953.5
CHANGE	87.9	36.1	9.6	6.4	0.5	0.1	-0.1	21.6
MASS OF MOISTURE COLLECTED, g								162.1

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	766.8	758.8	765.9	762.3	768.8	758.8	818.1	953.3
END	886.2	785.0	771.4	765.6	768.9	758.8	818.3	966.7
CHANGE	119.4	26.2	5.5	3.3	0.1	0.0	0.2	15.4
MASS OF MOISTURE COLLECTED, g								170.1

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

COMMENTS

\* JARZ  
10/3/16

EPA METHOD 2  
FIELD DATA SHEET



## EPA METHOD 5 - FIELD DATA SHEET - RUN 1

Project	Hibbing Taconite Company	Meter ID	C-5	Probe ID	10-4	Bar.Press.	28.18	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 2 SV027	Meter Y	1.0100	Pitot Tube No.	10-4	Stat Press.	-0.8	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/04/16	Orifice dH@	1.8825	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 7 in. Hg
Test	2 - Baseline Run # 1			Liner Type:	Glass	IMP Out TC	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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	135.04												
1	5.0	138.40	0.760	1.48	3.36	138.40	*	109	*	*	*	60	59	6.9
2	10.0	141.69	0.780	1.52	3.40	141.81	*	110	*	*	*	61	60	6.9
3	15.0	145.13	0.840	1.64	3.54	145.34	*	110	*	*	*	62	60	6.9
4	20.0	148.59	0.850	1.66	3.56	148.90	*	111	*	*	*	63	60	6.9
5	25.0	152.18	0.890	1.74	3.65	152.54	*	110	*	*	*	65	61	6.9
6	30.0	155.88	0.940	1.84	3.75	156.30	*	111	*	*	*	65	61	6.9
7	35.0	159.80	1.050	2.05	3.96	160.26	*	111	*	*	*	66	62	6.9
8	40.0	163.72	1.000	1.96	3.88	164.14	*	111	*	*	*	67	62	6.9
9	45.0	167.47	0.970	1.90	3.82	167.96	*	111	*	*	*	68	63	6.9
10	50.0	171.25	0.980	1.92	3.85	171.81	*	111	*	*	*	68	63	6.9
11	55.0	174.96	0.910	1.79	3.71	175.52	*	111	*	*	*	69	64	6.9
12	60.0	178.61	0.880	1.73	3.66	179.18	*	111	*	*	*	69	64	6.9
13	65.0	182.30	0.870	1.71	3.64	182.82	*	110	*	*	*	68	65	6.9
14	70.0	185.81	0.910	1.79	3.72	186.54	*	111	*	*	*	69	65	6.9
15	75.0	189.54	0.930	1.83	3.76	190.30	*	111	*	*	*	69	66	6.9
16	80.0	193.27	0.930	1.83	3.77	194.06	*	111	*	*	*	70	66	6.9
17	85.0	197.10	0.960	1.89	3.83	197.89	*	111	*	*	*	70	66	6.9
18	90.0	200.91	0.940	1.85	3.79	201.68	*	111	*	*	*	71	67	6.9
19	95.0	204.76	0.980	1.93	3.87	205.55	*	112	*	*	*	71	67	6.9
20	100.0	208.56	0.990	1.95	3.89	209.44	*	112	*	*	*	71	67	6.9
21	105.0	212.61	0.950	1.87	3.81	213.25	*	113	*	*	*	71	67	6.9
22	110.0	216.22	0.920	1.82	3.75	217.00	*	112	*	*	*	71	68	6.9
23	115.0	219.81	0.800	1.58	3.50	220.51	*	112	*	*	*	71	68	6.9
24	120.0	223.44	0.780	1.54	3.46	223.97	*	112	*	*	*	71	68	6.9
End Time	0:00													
Run Time	120		Avg DH=	1.78			Avg Ts=	111.04				Avg Tm=	65.94	

## Integrated Gas Sampling Data :

Bag No. T2-R1  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0607  
Nozzle No. glass  
Nozzle Dn. 0.215

## MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
835.5	829.3	778.8	762.7	780.5	769.7	779.1	967.6	
764.8	798.9	772.7	757.4	780.2	769.4	779.8	946.3	
70.7	30.4	6.1	5.3	0.3	0.3	-0.7	21.3	133.7

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 2

Project	Hibbing Taconite Company	Meter ID	C-5	Probe ID	10-4	Bar.Press.	28.18	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 2 SV027	Meter Y	1.0100	Pitot Tube No.	10-4	Stat Press.	-0.8	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/04/16	Orifice dH@	1.8825	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 8 in. Hg
Test	2 - Baseline Run # 2			Liner Type:	Glass	IMP Out TC	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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	223.77												
1	5.0	227.41	0.880	1.74	3.67	227.44	*	109	*	*	*	66	67	6.9
2	10.0	231.06	0.910	1.80	3.72	231.17	*	109	*	*	*	66	67	6.9
3	15.0	234.83	0.950	1.88	3.80	234.97	*	109	*	*	*	67	66	6.9
4	20.0	238.71	0.970	1.91	3.84	238.81	*	111	*	*	*	68	67	6.9
5	25.0	242.54	0.990	1.96	3.89	242.70	*	110	*	*	*	68	66	6.9
6	30.0	246.41	1.000	1.97	3.90	246.60	*	111	*	*	*	69	66	6.9
7	35.0	250.37	1.050	2.07	4.00	250.59	*	111	*	*	*	69	66	6.9
8	40.0	254.30	1.050	2.07	4.00	254.59	*	111	*	*	*	69	66	6.9
9	45.0	258.21	0.990	1.95	3.88	258.47	*	112	*	*	*	70	67	6.9
10	50.0	262.01	0.970	1.91	3.85	262.32	*	112	*	*	*	70	67	6.9
11	55.0	265.59	0.820	1.62	3.54	265.86	*	111	*	*	*	70	67	6.9
12	60.0	269.06	0.800	1.58	3.50	269.37	*	111	*	*	*	70	67	6.9
13	65.0	272.55	0.750	1.48	3.39	272.76	*	111	*	*	*	69	67	6.9
14	70.0	275.73	0.760	1.50	3.41	276.17	*	111	*	*	*	70	68	6.9
15	75.0	279.08	0.820	1.62	3.55	279.71	*	111	*	*	*	70	68	6.9
16	80.0	282.37	0.860	1.70	3.63	283.35	*	111	*	*	*	71	68	6.9
17	85.0	286.24	0.940	1.86	3.80	287.15	*	111	*	*	*	72	68	6.9
18	90.0	290.00	0.940	1.86	3.80	290.95	*	111	*	*	*	73	69	6.9
19	95.0	294.05	1.100	2.18	4.12	295.07	*	111	*	*	*	74	69	6.9
20	100.0	298.18	1.050	2.09	4.03	299.10	*	111	*	*	*	74	70	6.9
21	105.0	302.22	1.000	1.99	3.94	303.03	*	111	*	*	*	74	70	6.9
22	110.0	306.16	0.990	1.97	3.92	306.95	*	111	*	*	*	74	70	6.9
23	115.0	310.11	0.910	1.81	3.76	310.70	*	111	*	*	*	75	71	6.9
24	120.0	314.04	0.900	1.79	3.74	314.45	*	111	*	*	*	75	71	6.9
End Time	0:00													
Run Time	120		Avg DH=	1.85			Avg Ts=	110.79				Avg Tm=	69.19	

## Integrated Gas Sampling Data :

Bag No. T2-R2  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0606  
Nozzle No. glass  
Nozzle Dn. 0.215

## MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
827.0	785.4	777.5	772.9	775.8	763.3	765.1	959.0	
747.8	759.2	772.3	768.8	775.9	763.3	765.5	935.0	
79.2	26.2	5.2	4.1	-0.1	0	-0.4	24	138.2

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 3

Project	Hibbing Taconite Company	Meter ID	C-5	Probe ID	10-4	Bar.Press.	27.92	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 2 SV027	Meter Y	1.0100	Pitot Tube No.	10-4	Stat Press.	-0.8	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/05/16	Orifice dH@	1.8825	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 6 in. Hg
Test	2 - Baseline	Run #	3	Liner Type:	Glass	IMP Out TC	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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	314.38												
1	5.0	317.71	0.760	1.46	3.34	317.72	*	111	*	*	*	56	56	7.0
2	10.0	321.02	0.750	1.44	3.32	321.05	*	111	*	*	*	56	56	7.0
3	15.0	324.43	0.810	1.56	3.45	324.50	*	111	*	*	*	57	56	7.0
4	20.0	327.82	0.830	1.60	3.49	327.99	*	112	*	*	*	57	56	7.0
5	25.0	331.42	0.890	1.71	3.61	331.61	*	113	*	*	*	58	56	7.0
6	30.0	334.92	0.910	1.75	3.66	335.27	*	112	*	*	*	59	57	7.0
7	35.0	338.65	1.000	1.93	3.84	339.11	*	112	*	*	*	60	57	7.0
8	40.0	342.47	1.000	1.93	3.85	342.96	*	112	*	*	*	60	57	7.0
9	45.0	346.21	0.960	1.85	3.77	346.73	*	112	*	*	*	61	57	7.0
10	50.0	349.92	0.970	1.87	3.79	350.52	*	112	*	*	*	61	57	7.0
11	55.0	353.45	0.850	1.64	3.55	354.07	*	112	*	*	*	61	58	7.0
12	60.0	356.97	0.860	1.66	3.58	357.65	*	112	*	*	*	62	58	7.0
13	65.0	360.46	0.880	1.71	3.62	361.27	*	111	*	*	*	61	58	7.0
14	70.0	364.10	0.870	1.69	3.60	364.87	*	111	*	*	*	61	60	7.0
15	75.0	367.60	0.930	1.80	3.73	368.60	*	111	*	*	*	61	61	7.0
16	80.0	371.26	0.950	1.84	3.77	372.37	*	112	*	*	*	62	58	7.0
17	85.0	375.01	0.980	1.90	3.82	376.19	*	112	*	*	*	62	59	7.0
18	90.0	378.78	0.990	1.92	3.85	380.03	*	111	*	*	*	62	59	7.0
19	95.0	382.81	1.000	1.94	3.86	383.89	*	112	*	*	*	63	59	7.0
20	100.0	386.72	1.000	1.94	3.86	387.76	*	113	*	*	*	63	59	7.0
21	105.0	390.48	0.940	1.82	3.75	391.50	*	112	*	*	*	63	59	7.0
22	110.0	394.44	0.950	1.84	3.77	395.27	*	112	*	*	*	64	60	7.0
23	115.0	398.11	0.840	1.64	3.56	398.83	*	111	*	*	*	63	62	7.0
24	120.0	401.79	0.820	1.60	3.52	402.34	*	111	*	*	*	63	60	7.0
End Time	0:00													
Run Time	120		Avg DH=	1.75			Avg Ts=	111.71				Avg Tm=	59.40	

## Integrated Gas Sampling Data :

Bag No. T3-R3  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0608  
Nozzle No. glass  
Nozzle Dn. 0.215

## MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
827.1	784.9	777.7	769.9	772.2	763.6	762.8	953.5	
748.3	760.7	772.3	766.8	772.1	763.4	763.5	928.2	
78.8	24.2	5.4	3.1	0.1	0.2	-0.7	25.3	136.4

\* Data Recorded on Field Data Sheet



B  
ONTARIO HYDRO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-5 Probe ID 10-4 Bar. Pres 28.18 in Hg  
Smpl Loc Furnace Line 2 SV 027 B Meter Y 1.01 Pitot No. 10-4 Stat. Pres 20.80 in H<sub>2</sub>O  
Test No. 2-Baseline Run 1 Orifice H<sub>2</sub>O 1.8825 Pitot Cp 0.87 Probe Lgth 10 ft  
Date 10-4-16 Operators DFK/MSN/DAR 2 Liner Type: ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6268

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>7</u> in Hg
Pitot (3 in.)	Pos. <u>58</u>	Neg. <u>57</u>

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. ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		135.04											
A-6	5	138.40	0.76	1.48	2.5	109	261	251	55	60	59		
6	10	141.69	0.78	1.52	2.5	110	261	258	53	61	60		
5	15	145.13	0.84	1.64	2.5	110	260	257	53	62	60		
5	20	148.59	0.85	1.66	2.5	111	259	252	54	63	60		
4	25	152.18	0.89	1.74	3.0	110	261	252	56	65	61		
4	30	155.88	0.94	1.84	3.0	111	259	252	57	65	61		
3	35	159.80	1.05	2.05	3.5	111	260	257	58	66	62		
3	40	163.72	1.00	1.96	3.5	111	259	261	59	67	62		
2	45	167.47	0.97	1.90	3.5	111	261	259	60	68	63		
2	50	171.25	0.98	1.92	3.5	111	260	261	61	68	63		
1	55	174.96	0.91	1.79	3.5	111	260	255	62	69	64		
1	60	178.69	0.85	1.77	3.5	111	261	256	63	69	64		
B-6	65	182.30	0.87	1.71	3.5	110	260	255	65	68	65		
6	70	185.81	0.91	1.79	3.5	111	258	252	62	69	65		
5	75	189.54	0.93	1.83	3.5	111	259	252	62	69	66		
5	80	193.27	0.93	1.83	3.5	111	259	254	63	70	66		
4	85	197.10	0.96	1.89	4.0	111	260	253	65	70	66		
4	90	200.91	0.94	1.85	3.5	111	260	257	65	71	67		
3	95	204.76	0.95	1.93	4.5	112	262	262	67	71	67		
3	100	208.56	0.97	1.95	4.0	112	260	255	67	71	67		
2	105	212.61	0.95	1.87	4.0	113	261	261	67	71	67		
2	110	216.72	0.92	1.82	4.0	112	260	261	67	71	68		
1	115	219.81	0.80	1.57	4.0	112	257	253	63	71	68		
1	120	223.44	0.78	1.75	3.5	112	261	262	67	71	67		
Σ=		Vm=488.40	0.91	ΔH=1.78			ts=111.04				Tm=69.94		

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. <u>DFK</u>	Date <u>10-4-16</u>
Run 1	<u>60</u>	<u>20.0</u>	<u>1023</u>	<u>1224</u>	<u>72-01</u>	<u>15</u>	<u>0</u>	<u>400607</u>	<u>0.215</u>	<u>0.215</u>		
Run 2												
Avg. In.											<u>0.215</u>	

Moisture Recovery Data and impinger content information: See Impinger Recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>207.738</u>	<u>168.054</u>





B  
ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-5 Probe ID 10-4 Bar. Pres 28.18 in Hg  
Smpl Loc Furnace Line 2 SV 027 B Meter Y 1.01 Pitot No. 10-4 Stat. Pres -0.80 in H<sub>2</sub>O  
Test No. 2-Baseline Run 2 Orifice H@ 1.8825 Pitot Cp 0.87 Probe Lgth 10 ft  
Date 10-4-16 Operators 022/MSA/3AE27X Liner Type: ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6260

Sample Train Leak Rate (cfm)		
Pretest	<u>0.3</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 $\Delta t$	Meter Volume Vm, ft <sup>3</sup>	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 <sub>s</sub> , °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		223.17											
A-6	5	227.41	0.88	1.74	efile	30.5	109	260	257	49	66	67	
6	10	231.06	0.91	1.80		3.5	109	260	252	47	66	67	
5	15	234.83	0.95	1.88		3.5	109	259	258	48	67	66	
5	20	238.71	0.97	1.91		3.5	111	260	256	50	68	67	
4	25	242.44	0.99	1.96		4.0	110	259	257	50	67	66	
4	30	246.41	1.00	1.97		4.0	111	259	263	52	69	66	
3	35	250.37	1.05	2.07		4.0	111	260	257	51	69	65	
3	40	254.30	1.05	2.07		4.0	111	260	261	51	69	66	
2	45	258.21	0.99	1.95		4.0	112	261	258	52	70	67	
2	50	262.01	0.97	1.91		4.0	112	260	255	53	70	67	
1	55	265.59	0.82	1.62		3.5	111	261	257	56	70	67	
1	60	269.06	0.80	1.58		3.5	111	259	255	56	70	67	
B-6	65	272.55	0.75	1.48		3.5	111	253	251	60	69	67	
6	70	275.73	0.76	1.50		3.5	111	255	208	59	70	68	
5	75	279.08	0.82	1.62		3.5	111	260	260	61	71	68	
5	80	282.37	0.86	1.70		3.5	111	264	262	62	71	68	
4	85	286.24	0.94	1.86		4.0	111	261	252	62	72	68	
4	90	290.00	0.97	1.86		4.5	111	257	251	63	73	69	
3	95	294.05	1.10	2.18		5.0	111	252	251	63	74	69	
3	100	298.18	1.05	2.09		5.0	111	251	252	63	74	70	
2	105	302.22	1.00	1.99		5.0	111	253	257	63	74	70	
2	110	306.16	0.99	1.97		5.0	111	253	257	63	74	70	
1	115	310.11	0.91	1.81		5.0	111	256	257	63	75	71	
1	120	314.04	0.80	1.74			111	253	256	63	75	71	
Σ=		Vm=90.27	0.83	ΔH=1.85			T <sub>s</sub> =110.34					T <sub>m</sub> =69.19	

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			6.6			20.0			12:56	1:03	12-R2	15	0	400601	91035	0.215	1	See R1		
Run 2																	2			
																	3			
																	Avg. in.			

Moisture Recovery Data and impinger content information: See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
210,445	170,102



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-5 Probe ID 10-4 Bar. Pres 27.92 in Hg  
Smpl Loc Furnace Line 2 SV025 B Meter Y 1.01 Pitot No. 10-4 Stat. Pres 20.80 in H<sub>2</sub>O  
Test No. 2-Baseline Run 3 Orifice H@ 1.8825 Pitot Cp 0.87 Probe Lgth 10 ft  
Date 10-5-16 Operators 07E1/27V1/3AR2/1R Liner Type: ☒ Glass ☐ S.S. ☐ Other  
Imp TC 6268

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>10</u> in Hg
Posttest	<u>0.0</u>	at <u>6</u> in Hg
Pitot (3 in.)	Pos. <input checked="" type="checkbox"/> Neg. <input 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. ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		<u>314.38</u>											
A-6	5	<u>312.71</u>	<u>0.76</u>	<u>1.96</u>		<u>2.5</u>	<u>171</u>	<u>250</u>	<u>252</u>	<u>46</u>	<u>56</u>	<u>56</u>	
6	10	<u>321.02</u>	<u>0.75</u>	<u>1.47</u>		<u>2.5</u>	<u>111</u>	<u>262</u>	<u>259</u>	<u>55</u>	<u>56</u>	<u>56</u>	
5	15	<u>324.43</u>	<u>0.81</u>	<u>1.56</u>		<u>2.5</u>	<u>111</u>	<u>260</u>	<u>263</u>	<u>46</u>	<u>57</u>	<u>56</u>	
5	20	<u>327.52</u>	<u>0.83</u>	<u>1.60</u>		<u>2.5</u>	<u>112</u>	<u>259</u>	<u>261</u>	<u>47</u>	<u>57</u>	<u>56</u>	
4	25	<u>331.42</u>	<u>0.89</u>	<u>1.71</u>		<u>3.0</u>	<u>113</u>	<u>259</u>	<u>262</u>	<u>49</u>	<u>58</u>	<u>56</u>	
4	30	<u>334.92</u>	<u>0.91</u>	<u>1.75</u>		<u>3.0</u>	<u>112</u>	<u>261</u>	<u>263</u>	<u>50</u>	<u>59</u>	<u>57</u>	
3	35	<u>338.65</u>	<u>1.00</u>	<u>1.93</u>		<u>3.0</u>	<u>112</u>	<u>258</u>	<u>260</u>	<u>52</u>	<u>60</u>	<u>57</u>	
3	40	<u>342.47</u>	<u>1.00</u>	<u>1.93</u>		<u>3.0</u>	<u>112</u>	<u>261</u>	<u>258</u>	<u>52</u>	<u>60</u>	<u>57</u>	
2	45	<u>346.21</u>	<u>0.96</u>	<u>1.85</u>		<u>3.5</u>	<u>112</u>	<u>258</u>	<u>257</u>	<u>52</u>	<u>61</u>	<u>57</u>	
2	50	<u>349.92</u>	<u>0.97</u>	<u>1.87</u>		<u>3.5</u>	<u>112</u>	<u>261</u>	<u>262</u>	<u>55</u>	<u>61</u>	<u>57</u>	
1	55	<u>353.45</u>	<u>0.88</u>	<u>1.67</u>		<u>3.0</u>	<u>112</u>	<u>259</u>	<u>257</u>	<u>55</u>	<u>61</u>	<u>58</u>	
1	60	<u>354.97</u>	<u>0.86</u>	<u>1.66</u>		<u>3.0</u>	<u>112</u>	<u>259</u>	<u>256</u>	<u>56</u>	<u>62</u>	<u>58</u>	
B-6	65	<u>360.46</u>	<u>0.88</u>	<u>1.71</u>		<u>3.0</u>	<u>111</u>	<u>260</u>	<u>260</u>	<u>56</u>	<u>61</u>	<u>58</u>	
6	70	<u>364.10</u>	<u>0.87</u>	<u>1.69</u>		<u>3.0</u>	<u>111</u>	<u>259</u>	<u>258</u>	<u>56</u>	<u>61</u>	<u>60</u>	
5	75	<u>367.60</u>	<u>0.93</u>	<u>1.81</u>		<u>3.5</u>	<u>111</u>	<u>260</u>	<u>262</u>	<u>58</u>	<u>61</u>	<u>61</u>	
5	80	<u>371.26</u>	<u>0.95</u>	<u>1.84</u>		<u>3.5</u>	<u>112</u>	<u>260</u>	<u>261</u>	<u>60</u>	<u>62</u>	<u>58</u>	
4	85	<u>375.01</u>	<u>0.98</u>	<u>1.90</u>		<u>3.5</u>	<u>112</u>	<u>260</u>	<u>261</u>	<u>61</u>	<u>62</u>	<u>59</u>	
4	90	<u>378.73</u>	<u>0.99</u>	<u>1.92</u>		<u>3.5</u>	<u>111</u>	<u>260</u>	<u>261</u>	<u>61</u>	<u>62</u>	<u>59</u>	
3	95	<u>382.81</u>	<u>1.00</u>	<u>1.94</u>		<u>3.5</u>	<u>112</u>	<u>260</u>	<u>258</u>	<u>61</u>	<u>63</u>	<u>59</u>	
3	100	<u>386.72</u>	<u>1.00</u>	<u>1.97</u>		<u>3.5</u>	<u>113</u>	<u>261</u>	<u>259</u>	<u>62</u>	<u>63</u>	<u>59</u>	
2	105	<u>390.43</u>	<u>0.97</u>	<u>1.82</u>		<u>3.5</u>	<u>112</u>	<u>260</u>	<u>261</u>	<u>62</u>	<u>63</u>	<u>59</u>	
2	110	<u>394.44</u>	<u>0.95</u>	<u>1.84</u>		<u>3.5</u>	<u>112</u>	<u>259</u>	<u>259</u>	<u>62</u>	<u>64</u>	<u>60</u>	
1	115	<u>398.11</u>	<u>0.84</u>	<u>1.64</u>		<u>3.0</u>	<u>111</u>	<u>261</u>	<u>261</u>	<u>63</u>	<u>63</u>	<u>62</u>	
1	120	<u>401.79</u>	<u>0.82</u>	<u>1.60</u>		<u>3.0</u>	<u>111</u>	<u>261</u>	<u>258</u>	<u>63</u>	<u>63</u>	<u>60</u>	
Σ=		Vm= <u>37.41</u>	<u>0.91</u>	ΔH= <u>1.75</u>			Ts= <u>111.71</u>					Tm= <u>54.60</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>56</u>	<u>20.0</u>	<u>7.03</u>	<u>0745</u>	<u>0950</u>	<u>13-23</u>	<u>15</u>	<u>0</u>	<u>400608</u>	<u>9148</u>	<u>0.215</u>	
Run 2												
											Avg. in.	

Moisture Recovery Data and impinger content information:

See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>208.555</u>	<u>166.612</u>



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
IMPINGER RECOVERY

Project HTC - BASELINE

Date 10/04/2016

Project No. 23691428.63 BASE 200 Operators TYL

Source SV027-B Sample Location STACK

TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
START.	764.8	798.9	772.7	757.4	780.2	769.4	779.8	946.3
END	835.5	829.3	778.8	762.7	780.5	769.7	779.1	967.6
CHANGE	70.7	30.4	6.1	5.3	0.3	0.3	-0.7	21.3
MASS OF MOISTURE COLLECTED, g								133.7

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
START. 1256	747.8	759.2	772.3	768.8	775.9	763.3	765.5	935.0
END	821.0	785.4	777.5	775.8	775.8	763.3	765.1	959.0
CHANGE	79.2	26.2	5.2	772.9	-0.1	0.0	-0.4	24.0
4.1 MASS OF MOISTURE COLLECTED, g								138.2

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	
START. 0745	748.3	760.7	772.3	766.8	772.1	763.4	763.5	928.2
END	827.1	784.9	777.7	769.9	772.2	763.6	762.8	953.5
CHANGE	79.8	24.2	5.4	3.1	0.1	0.2	-0.7	25.3
MASS OF MOISTURE COLLECTED, g								136.4

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

COMMENTS

10/05/16

**EPA METHOD 2**  
**FIELD DATA SHEET**



## EPA METHOD 5 - FIELD DATA SHEET - RUN 1

Project	Hibbing Taconite Company	Meter ID	C-5	Probe ID	10-4	Bar.Press.	28.33	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 1 SV028	Meter Y	1.0100	Pitot Tube No.	10-4	Stat Press.	-0.8	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/03/16	Orifice dH@	1.8825	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 8 in. Hg
Test	1 - Baseline Run # 1			Liner Type:	Glass	IMP Out TC	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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	856.74												
1	5.0	860.18	0.750	1.51	3.37	860.11	*	100	*	*	*	56	56	5.5
2	10.0	863.61	0.760	1.53	3.40	863.51	*	100	*	*	*	57	56	5.5
3	15.0	867.07	0.850	1.71	3.59	867.10	*	100	*	*	*	59	57	5.5
4	20.0	870.50	0.880	1.78	3.67	870.77	*	100	*	*	*	60	57	5.5
5	25.0	874.08	0.950	1.92	3.81	874.58	*	100	*	*	*	61	58	5.5
6	30.0	877.85	0.980	1.99	3.88	878.46	*	99	*	*	*	63	58	5.5
7	35.0	881.72	0.970	1.97	3.87	882.33	*	100	*	*	*	64	59	5.5
8	40.0	885.68	1.000	2.04	3.93	886.27	*	100	*	*	*	68	67	5.5
9	45.0	889.59	0.980	2.02	3.94	890.20	*	100	*	*	*	69	67	5.5
10	50.0	893.56	0.970	2.00	3.92	894.13	*	100	*	*	*	70	68	5.5
11	55.0	897.32	0.850	1.76	3.68	897.81	*	100	*	*	*	72	68	5.5
12	60.0	900.94	0.820	1.70	3.62	901.43	*	100	*	*	*	73	69	5.5
13	65.0	904.61	0.900	1.87	3.80	905.24	*	99	*	*	*	73	70	5.5
14	70.0	908.37	0.900	1.87	3.81	909.04	*	99	*	*	*	73	70	5.5
15	75.0	912.14	0.930	1.93	3.87	912.91	*	100	*	*	*	73	70	5.5
16	80.0	916.08	0.960	2.00	3.93	916.84	*	99	*	*	*	74	71	5.5
17	85.0	920.08	1.000	2.08	4.02	920.86	*	100	*	*	*	74	71	5.5
18	90.0	924.07	1.000	2.08	4.02	924.88	*	100	*	*	*	76	71	5.5
19	95.0	928.25	1.050	2.19	4.13	929.00	*	99	*	*	*	76	72	5.5
20	100.0	932.51	1.100	2.30	4.23	933.23	*	99	*	*	*	77	72	5.5
21	105.0	936.46	0.990	2.07	4.01	937.24	*	100	*	*	*	77	73	5.5
22	110.0	940.46	0.990	2.07	4.02	941.26	*	99	*	*	*	77	73	5.5
23	115.0	944.34	0.870	1.82	3.77	945.02	*	100	*	*	*	78	73	5.5
24	120.0	948.21	0.870	1.82	3.77	948.80	*	99	*	*	*	78	74	5.5
End Time	0:00													
Run Time	120		Avg DH=	1.92			Avg Ts=	99.67				Avg Tm=	68.29	

Integrated Gas Sampling Data :

Bag No.	T1-R1
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0600
Nozzle No.	glass
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
806.5	827.8	773.9	758.2	770.6	763.3	772.0	985.1	
761.0	798.6	767.7	754.0	769.3	762.8	771.0	957.0	
45.5	29.2	6.2	4.2	1.3	0.5	1	28.1	116

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 2

Project	Hibbing Taconite Company	Meter ID	C-5	Probe ID	10-4	Bar.Press.	28.33	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 1 SV028	Meter Y	1.0100	Pitot Tube No.	10-4	Stat Press.	-0.8	in. H2O	Pretest 0.000 at 10 in. Hg
Date	10/03/16	Orifice dH@	1.8825	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 8 in. Hg
Test	1 - Baseline Run # 2			Liner Type:	Glass	IMP Out TC	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	0:00	950.63												
1	5.0	954.16	0.830	1.73	3.67	954.30	*	100	*	*	*	74	74	5.5
2	10.0	957.81	0.870	1.81	3.76	958.06	*	101	*	*	*	75	74	5.5
3	15.0	961.61	0.920	1.92	3.86	961.92	*	101	*	*	*	76	74	5.5
4	20.0	965.57	0.950	1.98	3.93	965.85	*	101	*	*	*	77	74	5.5
5	25.0	969.48	0.990	2.07	4.02	969.87	*	100	*	*	*	78	75	5.5
6	30.0	973.51	1.000	2.10	4.05	973.92	*	99	*	*	*	78	75	5.5
7	35.0	977.65	1.050	2.20	4.14	978.07	*	100	*	*	*	79	75	5.5
8	40.0	981.85	1.050	2.20	4.15	982.22	*	100	*	*	*	79	75	5.5
9	45.0	986.04	0.990	2.08	4.03	986.24	*	100	*	*	*	79	76	5.5
10	50.0	990.13	0.980	2.06	4.01	990.26	*	100	*	*	*	79	76	5.5
11	55.0	993.83	0.850	1.78	3.74	994.00	*	100	*	*	*	79	76	5.5
12	60.0	997.60	0.850	1.78	3.74	997.74	*	100	*	*	*	79	76	5.5
13	65.0	1001.02	0.740	1.55	3.49	1001.23	*	100	*	*	*	77	76	5.5
14	70.0	1004.55	0.770	1.61	3.55	1004.79	*	100	*	*	*	78	76	5.5
15	75.0	1008.22	0.850	1.78	3.74	1008.52	*	100	*	*	*	78	76	5.5
16	80.0	1011.91	0.850	1.78	3.73	1012.26	*	101	*	*	*	78	76	5.5
17	85.0	1015.78	0.900	1.88	3.84	1016.10	*	101	*	*	*	78	76	5.5
18	90.0	1019.47	0.900	1.88	3.84	1019.94	*	101	*	*	*	79	75	5.5
19	95.0	1023.60	1.000	2.09	4.05	1023.98	*	101	*	*	*	79	76	5.5
20	100.0	1027.55	1.000	2.09	4.05	1028.03	*	102	*	*	*	79	76	5.5
21	105.0	1031.65	0.970	2.03	3.99	1032.02	*	101	*	*	*	79	76	5.5
22	110.0	1035.58	0.970	2.03	3.99	1036.01	*	101	*	*	*	79	76	5.5
23	115.0	1039.48	0.880	1.85	3.81	1039.81	*	100	*	*	*	79	76	5.5
24	120.0	1043.31	0.880	1.84	3.80	1043.62	*	101	*	*	*	78	76	5.5
End Time	0:00													
Run Time	120		Avg DH=	1.92			Avg Ts=	100.46				Avg Tm=	76.75	

Integrated Gas Sampling Data :

Bag No.	T1-R2
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0601
Nozzle No.	glass
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
797.6	791.7	776.4	773.8	765.4	749.1	746.8	946.8	
742.6	757.3	772.8	769.1	765.5	748.4	746.1	926.3	
55	34.4	3.6	4.7	-0.1	0.7	0.7	20.5	119.5

\* Data Recorded on Field Data Sheet



## EPA METHOD 5 - FIELD DATA SHEET - RUN 3

Project	Hibbing Taconite Company	Meter ID	C-5	Probe ID	10-4	Bar.Press.	28.18	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Pellet Indurating Furnace Line 2 - Stack 1 SV028	Meter Y	1.0100	Pitot Tube No.	10-4	Stat Press.	-0.8	in. H <sub>2</sub> O	Pretest 0.000 at 10 in. Hg
Date	10/04/16	Orifice dH@	1.8825	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 8 in. Hg
Test	1 - Baseline Run # 3			Liner Type:	Glass	IMP Out TC	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, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	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	0:00	43.64												
1	5.0	47.07	0.790	1.56	3.42	47.06	*	100	*	*	*	51	51	6.0
2	10.0	50.38	0.810	1.60	3.47	50.53	*	99	*	*	*	51	51	6.0
3	15.0	53.88	0.870	1.72	3.59	54.12	*	100	*	*	*	52	51	6.0
4	20.0	57.46	0.850	1.68	3.55	57.67	*	100	*	*	*	53	51	6.0
5	25.0	61.21	0.960	1.90	3.78	61.45	*	100	*	*	*	54	51	6.0
6	30.0	65.01	0.960	1.90	3.78	65.23	*	100	*	*	*	55	52	6.0
7	35.0	68.87	1.050	2.09	3.96	69.19	*	100	*	*	*	56	52	6.0
8	40.0	72.78	1.050	2.09	3.96	73.15	*	100	*	*	*	57	53	6.0
9	45.0	76.64	1.050	2.09	3.97	77.12	*	101	*	*	*	58	53	6.0
10	50.0	80.51	1.000	1.99	3.88	81.00	*	100	*	*	*	58	53	6.0
11	55.0	84.17	0.940	1.87	3.76	84.77	*	100	*	*	*	59	54	6.0
12	60.0	87.70	0.920	1.84	3.73	88.50	*	100	*	*	*	59	54	6.0
13	65.0	91.37	0.910	1.82	3.71	92.21	*	99	*	*	*	58	55	6.0
14	70.0	95.02	0.920	1.84	3.73	95.94	*	100	*	*	*	58	55	6.0
15	75.0	98.67	0.940	1.88	3.77	99.72	*	100	*	*	*	59	55	6.0
16	80.0	102.54	0.960	1.92	3.81	103.53	*	100	*	*	*	60	55	6.0
17	85.0	106.64	1.050	2.10	3.99	107.52	*	100	*	*	*	60	56	6.0
18	90.0	110.57	1.100	2.20	4.09	111.61	*	100	*	*	*	61	56	6.0
19	95.0	114.71	1.100	2.21	4.10	115.70	*	99	*	*	*	61	56	6.0
20	100.0	118.87	1.100	2.21	4.09	119.80	*	100	*	*	*	61	57	6.0
21	105.0	122.97	1.000	2.01	3.91	123.70	*	100	*	*	*	62	57	6.0
22	110.0	127.11	1.000	2.01	3.91	127.61	*	100	*	*	*	62	57	6.0
23	115.0	130.92	0.930	1.87	3.77	131.39	*	100	*	*	*	62	58	6.0
24	120.0	134.65	0.900	1.81	3.72	135.10	*	100	*	*	*	63	58	6.0
End Time	0:00													
Run Time	120		Avg DH=	1.93			Avg Ts=	99.92				Avg Tm=	56.06	

Integrated Gas Sampling Data :

Bag No.	T1-R3
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0602
Nozzle No.	glass
Nozzle Dn.	0.215

MOISTURE RECOVERY DATA :

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

1	2	3	4	5	6	7	Desiccant	Total
817.5	781.5	775.0	771.4	768.8	758.5	752.1	1002.8	
745.8	760.2	770.9	767.7	768.9	758.3	753.3	983.5	
71.7	21.3	4.1	3.7	-0.1	0.2	-1.2	19.3	119

\* Data Recorded on Field Data Sheet



A  
ONTARIO HYDRO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-5 Probe ID 10-7 Bar. Pres 28.33 in Hg  
Smpl Loc Furnace Line 2 SV 023 A Meter Y 101 Pitot No. 10-7 Stat. Pres 28.83 in H<sub>2</sub>O  
Test No. Baseline Run 1 Orifice H@ 1.8825 Pitot Cp 0.84 Probe Lgth 10 ft  
Date 10-3-16 Operators DSK/mjn/jdr Liner Type: ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 6268

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 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	
		836.44											
A-6	5	860.18	0.88	1.88	2.00	100	248	248	53	57	56		
6	10	863.61	0.86	1.87	2.00	100	248	251	50	52	56		
5	15	867.07	0.85	1.87	2.00	100	249	251	49	59	57		
5	20	870.50	0.88	1.88	2.00	100	249	250	49	60	57		
4	25	874.08	0.95	1.92	2.00	100	249	250	49	61	58		
4	30	877.85	0.98	1.99	2.5	99	249	250	51	63	58		
3	35	881.72	0.97	1.97	2.0	100	249	249	52	64	59		
3	40	885.68	1.00	2.08	2.5	100	255	254	64	68	67		
2	45	889.59	0.98	2.02	3.5	100	252	254	62	69	67		
2	50	893.56	0.97	2.00	3.5	100	251	254	62	70	68		
1	55	897.32	0.85	1.76	3.5	100	253	251	62	72	68		
1	60	900.94	0.82	1.70	3.5	100	254	252	61	73	69		
B-6	65	904.61	0.90	1.87	3.5	99	251	251	66	73	70		
6	70	908.37	0.90	1.87	3.5	99	237	248	64	73	70		
5	75	912.14	0.93	1.93	3.5	100	253	251	62	73	70		
5	80	916.08	0.96	2.00	3.5	99	250	252	61	74	71		
4	85	920.08	1.00	2.08	4.0	100	252	252	60	74	71		
4	90	924.07	1.00	2.08	4.0	100	254	253	61	76	71		
3	95	928.25	2.05	2.19	4.5	99	254	255	61	76	72		
3	100	932.51	1.10	2.30	5.0	99	254	249	61	77	72		
2	105	936.46	0.99	2.07	4.5	100	260	242	61	77	73		
2	110	940.46	0.99	2.08	4.5	99	261	252	62	77	73		
1	115	944.34	0.87	1.82	4.5	100	260	250	62	78	73		
1	120	948.21	0.87	1.82	4.5	99	264	253	62	78	74		
Σ=		Vm=91.47	0.93	ΔH=1.92			T <sub>s</sub> =99.67				T <sub>m</sub> =68.29		

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. <u>DSK</u>	Date <u>10-3-16</u>
Run 1	<u>5.5</u>	<u>19.5</u>	<u>1035</u>	<u>1415</u>	<u>T1-R1</u>	<u>15</u>	<u>0</u>	<u>420600</u>	<u>91435</u>	<u>0.215</u>	Nozzle No. <u>0.215</u>	
Run 2												
										Avg. in.	<u>0.215</u>	

Moisture Recovery Data and impinger content information: See Impinger Recovery Data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
<u>207.069</u>	<u>123.765</u>





ONTARIO HYDRO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-5 Probe ID 10-Y Bar. Pres 2833 in Hg  
Smpl Loc Furnace Line 2 SV 024 A Meter Y 1.01 Pitot No. 10-Y Stat. Pres -0.83 in H<sub>2</sub>O  
Test No. 1-Baseline Run 2 Orifice H@ 1.8825 Pitot Cp 0.87 Probe Lgth 10 ft  
Date 10-3-16 Operators DK/MSN/SARZ Liner Type: ☒ Glass ☐ S.S. ☐ Other Imp TC 6268

Sample Train Leak Rate (cfm)			
Pretest	0.0	at	10 in Hg
Posttest	0.0	at	8 in Hg
Pitot (3 in.) Pos.	<input checked="" type="checkbox"/> Neg.	<input 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. ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		950.63											
A-6	5	957.16	0.83	1.73		3.5	100	260	262	57	77	77	
6	10	957.81	0.82	1.81		4.0	101	260	263	53	75	77	
5	15	961.61	0.92	1.92		4.0	101	260	260	53	76	77	
5	20	965.57	0.95	2.98		4.0	101	261	260	57	77	77	
4	25	969.44	0.99	2.02		4.5	100	260	262	55	78	75	
4	30	973.51	1.00	2.10		4.5	99	260	262	55	78	75	
3	35	977.65	1.05	2.20		4.5	100	261	262	55	79	75	
3	40	981.85	1.05	2.20		5.0	100	260	260	55	79	78	
2	45	986.04	0.99	2.08		5.0	100	261	259	56	79	76	
2	50	990.13	0.98	2.06		5.0	100	264	265	56	79	76	
1	55	993.83	0.85	1.78		4.5	100	258	257	57	79	76	
1	60	997.60	0.85	1.78		4.5	100	259	257	57	79	76	
B-6	65	1001.02	0.74	1.85		3.5	100	244	237	53	77	76	
6	70	1004.55	0.77	1.61		4.0	100	238	242	48	78	76	
5	75	1008.22	0.85	1.78		4.0	100	242	250	50	78	76	
5	80	1011.91	0.85	1.78		4.0	101	242	250	51	78	76	
4	85	1015.78	0.90	1.88		4.5	101	246	247	51	78	76	
4	90	1019.47	0.90	1.88		4.5	101	247	246	51	79	75	
3	95	1023.60	1.00	2.09		5.0	101	251	252	51	79	76	
3	100	1027.95	1.00	2.09		5.0	102	244	244	53	79	76	
2	105	1031.65	0.97	2.09		5.0	101	249	250	53	79	76	
2	110	1035.58	0.97	2.03		5.0	101	251	253	55	79	76	
1	115	1039.46	0.84	1.85		4.5	100	251	246	55	79	76	
1	120	1043.41	0.88	1.87		4.5	101	252	246	56	78	76	
Σ=		Vm=92.60	0.92	ΔH=1.92			Ts=100.46					Tm=76.35	

	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	20.2	5.5	15:05	17:12	17-R2	15	0	400601	91451	0.211	See R1
Run 2												

Moisture Recovery Data and impinger content information: See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
	1 N KCl			HNO3/H2O2		H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
205.993	172.287



A  
ONTARIO HYDRO D-6784-02 MERCURY TESTING  
FIELD DATA SHEET

Project Hibbing Taconite Company Meter ID C-5 Probe ID 10-4 Bar. Pres 28.18 in Hg  
Smpl Loc Furnace Line 2 SV 023 A Meter Y 1.01 Pitot No. 10-4 Stat. Pres 20.83 in H<sub>2</sub>O  
Test No. Baseline Run 3 Orifice H@ 1.8825 Pitot Cp 0.84 Probe Lgth 10 ft  
Date 10-4-16 Operators DJK/AM/JAR Liner Type: ☒ Glass ☐ S.S. ☐ Other Imp TC 6268  
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, 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. ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
								Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
		43.64											
A-6	5	47.06	0.79	1.56		2.5	100	260	262	43	51	51	
6	10	50.38	0.81	1.60		2.5	99	260	256	42	51	51	
5	15	53.58	0.87	1.72		2.5	100	260	261	43	52	51	
5	20	57.46	0.85	1.68		2.5	100	260	263	43	53	51	
4	25	61.21	0.96	1.90		3.5	100	259	257	44	54	51	
4	30	65.01	0.96	1.90		3.5	100	261	264	40	55	52	
3	35	68.87	1.05	2.09		4.0	100	258	254	40	56	52	
3	40	72.76	1.05	2.09		4.0	100	259	256	46	57	53	
2	45	76.64	1.05	2.09		4.0	101	259	261	46	58	53	
2	50	80.51	1.00	1.94		4.0	100	260	261	46	58	53	
1	55	84.17	0.94	1.87		3.5	100	261	262	47	59	54	
1	60	87.70	0.92	1.84		3.5	100	250	255	48	59	54	
B-6	65	91.37	0.91	1.82		3.5	99	261	262	49	58	55	
6	70	95.02	0.92	1.84		3.5	100	260	261	44	58	55	
5	75	98.67	0.94	1.88		3.5	100	254	258	50	59	55	
5	80	102.54	0.96	1.92		3.5	100	254	258	50	60	55	
4	85	106.64	1.05	2.10		4.0	100	254	253	52	60	56	
4	90	110.57	1.10	2.20		4.5	100	261	260	54	61	56	
3	95	114.71	1.10	2.21		4.5	99	261	260	58	61	56	
3	100	118.87	1.10	2.21		4.5	100	259	253	55	61	57	
2	105	122.97	1.00	2.01		4.5	100	261	262	57	62	57	
2	110	127.11	1.00	2.01		4.5	100	260	264	58	62	57	
1	115	130.92	0.93	1.87		4.0	100	260	260	60	62	58	
1	120	134.65	0.90	1.81		4.0	100	261	263	60	63	58	
Σ		Vm=91.01	0.97	ΔH=1.93			Ts=99.92					Tm=56.06	

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
50	26.2	6.0	746	953	T1-R3	15	0	400602	91955	0.213	1	See RT
Run 1											2	
Run 2											3	
											Avg. in.	

Moisture Recovery Data and impinger content information: See impinger recovery data sheet

Impinger	1	2	3	4	5	6	7	Desiccant	Total
Final wt., g									
Initial wt., g									
Difference									
1 N KCl			HNO3/H2O2			H2SO4/KMNO4			

Air Flows	
ACFM	DSCFM
211,577	176,400



ONTARIO HYRDO D-6784-02 MERCURY TESTING  
IMPINGER RECOVERY

Project NTC - Bedline Date 10/3/2016  
Project No. 23091428.103 BASE 200 Operators TYL  
Source SJ028 - A Sample Location Stack

TEST RUN 1	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	761.0	798.6	767.7	754.0	769.3	762.8	771.0	957.0
END	806.5	827.8	773.9	758.2	770.6	763.3	772.0	985.1
CHANGE	45.5	29.2	6.2	4.2	1.3	0.5	1.0	28.1
MASS OF MOISTURE COLLECTED, g								116.0

TEST RUN 2	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START.	742.6	757.3	772.8	769.1	765.5	748.4	746.1	926.3
END	757.6	791.7	776.4	773.8	765.4	749.1	746.8	946.8
CHANGE	55.0	34.4	3.6	4.7	-0.1	0.7	0.7	20.5
MASS OF MOISTURE COLLECTED, g								119.5

TEST RUN 3	IMPINGER VOLUMES							DRY COLUMN
	1	2	3	4	5	6	7	
	g	g	g	g	g	g	g	g
START. 746	745.8	760.2	770.9	767.7	768.9	758.3	753.3	983.5
END	817.5	781.5	775.0	771.4	768.8	758.5	752.1	1002.8
CHANGE	71.7	21.3	4.1	3.7	-0.1	0.2	-1.2	19.3
MASS OF MOISTURE COLLECTED, g								119.0

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

COMMENTS

## **Appendix C**

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

Results of Gravimetric Particulate Analysis  
Pellet Indurating Furnace Line 2 - Stack 4 (SV025)

Test Date: 10/4-5/2016

Test 4 - Baseline

**Method 5 Particulate Mass Determination**

Inputs	Symbol	Units	Run 1	Run 2	Run 3	Blanks
Air Filter - Net Particulate Mass	$M_{af}$	g	0.01931	0.01802	0.01828	0.00016
Probe Wash - Net Residue Mass	$M_{pw}$	g	0.00769	0.00641	0.00442	-0.00025
Probe Wash Volume	$V_{pw}$	ml	200	185	145	150
<b>Calculations</b>						
Probe Wash Blank Correction Amount $C_{pw} = V_{pw} \times M_{pw(blank)} \div V_{pw(blank)}$	$C_{pw}$	g	0.00000	0.00000	0.00000	
Probe Wash Final Mass $M_{pwf} = M_{pw} - C_{pw}$	$M_{pwf}$	g	0.00769	0.00641	0.00442	
<b>Filterable Particulate Matter (PM) Mass</b> $M_{PM} = M_{af} + M_{pwf}$	$M_{PM}$	g	<b>0.02699</b>	<b>0.02443</b>	<b>0.02270</b>	



## LABORATORY REPORT

### PARTICULATE TESTING FRONT HALF GRAVIMETRIC RESULTS

CLIENT HTC

PROJECT NO. 23/69-1428.63 BASE-200

TEST T4 - Baseline

TEST DATE 10/4-5/2016

SOURCE ID Line 2 SV025

SAMPLING LOCATION Stack D

SAMPLES COLLECTED BY JAR2

AIR FILTERS: 4 INCH GFF

ANALYZED ON:

ANALYSIS PERFORMED BY ROB

Run	Filter ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)
R1	4Q0609	Dark red particulate	0.79629	10/12/2016 19:35	0.77698	9/24/2016 15:45	0.01931
			0.79625	10/13/2016 9:44	0.77687	9/28/2016 22:36	
			0.79621	10/13/2016 17:40			
R2	4Q0610	Dark red particulate	0.79784	10/12/2016 19:33	0.77985	9/24/2016 15:44	0.01802
			0.79780	10/13/2016 9:45	0.77971	9/28/2016 22:40	
			0.79780	10/13/2016 17:38			
R3	4Q0611	Dark red particulate	0.79475	10/12/2016 19:31	0.77647	9/24/2016 15:44	0.01828
			0.79473	10/13/2016 9:47	0.77638	9/28/2016 22:41	
			0.79468	10/13/2016 17:35			
R0	4Q0615	Dark red particulate	0.77643	10/12/2016 19:29	0.77636	9/24/2016 15:40	0.00016
			0.77645	10/13/2016 9:49	0.77631	9/28/2016 22:45	
			0.77653	10/13/2016 17:47			

#### PROBE WASH: ACETONE

Run	Beaker ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)	Solvent Volume (ml)	Evidence of Sample Loss?
R1	1009	Red-brown particulate	125.91137	10/12/2016 19:05	125.90332	10/9/2016 18:05	0.00769	200	No
			125.91137	10/13/2016 9:33	125.90367	10/10/2016 12:01			
			125.91153	10/13/2016 17:22	125.90386	10/10/2016 21:12			
R2	1010	Red-brown particulate	128.41849	10/12/2016 19:07	128.41164	10/9/2016 18:04	0.00641	185	No
			128.41855	10/13/2016 9:32	128.41208	10/10/2016 12:02			
			128.41862	10/13/2016 17:21	128.41227	10/10/2016 21:11			
R3	1011	Red-brown particulate	125.46580	10/12/2016 19:08	125.46084	10/9/2016 18:02	0.00442	145	No
			125.46578	10/13/2016 9:31	125.46132	10/10/2016 12:05			
			125.46594	10/13/2016 17:19	125.46156	10/10/2016 21:10			
R0	1015	Clean	127.35477	10/12/2016 19:09	127.35477	10/9/2016 17:57	-0.00025	150	No
			127.35478	10/13/2016 9:29	127.35491	10/10/2016 12:17			
			127.35499	10/13/2016 17:17	127.35536	10/10/2016 21:04			

#### REMARKS

Results of Gravimetric Particulate Analysis  
Pellet Indurating Furnace Line 2 - Stack 3 (SV026)

Test Date: 10/3-4/2016

Test 3 - Baseline

**Method 5 Particulate Mass Determination**

Inputs	Symbol	Units	Run 1	Run 2	Run 3	Blanks
Air Filter - Net Particulate Mass	$M_{af}$	g	0.01915	0.01907	0.01926	0.00016
Probe Wash - Net Residue Mass	$M_{pw}$	g	0.00376	0.00580	0.00891	-0.00025
Probe Wash Volume	$V_{pw}$	ml	150	195	170	150
<b>Calculations</b>						
Probe Wash Blank Correction Amount $C_{pw} = V_{pw} \times M_{pw(blank)} \div V_{pw(blank)}$	$C_{pw}$	g	0.00000	0.00000	0.00000	
Probe Wash Final Mass $M_{pwf} = M_{pw} - C_{pw}$	$M_{pwf}$	g	0.00376	0.00580	0.00891	
<b>Filterable Particulate Matter (PM) Mass</b> $M_{PM} = M_{af} + M_{pwf}$	$M_{PM}$	g	<b>0.02291</b>	<b>0.02487</b>	<b>0.02817</b>	



## LABORATORY REPORT

### PARTICULATE TESTING FRONT HALF GRAVIMETRIC RESULTS

CLIENT HTC

PROJECT NO. 23/69-1428.63 BASE-200

TEST T3-Baseline

TEST DATE 10/3-4/2016

SOURCE ID Line 2 SV026

SAMPLING LOCATION Stack C

SAMPLES COLLECTED BY JAR2

AIR FILTERS: 4 INCH GFF

ANALYZED ON:

ANALYSIS PERFORMED BY ROB

Run	Filter ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)
R1	4Q0603	Dark red particulate	0.80237	10/12/2016 19:40	0.78319	9/24/2016 15:13	0.01915
			0.80233	10/13/2016 9:54	0.78311	9/28/2016 22:18	
			0.80226	10/13/2016 17:28			
R2	4Q0604	Dark red particulate	0.79489	10/12/2016 19:42	0.77574	9/24/2016 15:12	0.01907
			0.79474	10/13/2016 9:53	0.77566	9/28/2016 22:20	
			0.79480	10/13/2016 17:30			
R3	4Q0605	Dark red particulate	0.79925	10/12/2016 19:39	0.77994	9/24/2016 15:11	0.01926
			0.79914	10/13/2016 9:55	0.77984	9/28/2016 22:21	
			0.79915	10/13/2016 17:27			
R0	4Q0615	Dark red particulate	0.77643	10/12/2016 19:29	0.77636	9/24/2016 15:40	0.00016
			0.77645	10/13/2016 9:49	0.77631	9/28/2016 22:45	
			0.77653	10/13/2016 17:47			

#### PROBE WASH: ACETONE

Run	Beaker ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)	Solvent Volume (ml)	Evidence of Sample Loss?
R1	1003	Red-brown particulate	127.36408	10/12/2016 19:18	127.35990	10/9/2016 18:14	0.00376	150	No
			127.36410	10/13/2016 9:17	127.36040	10/10/2016 11:50			
			127.36438	10/13/2016 17:03	127.36055	10/10/2016 21:23			
R2	1004	Red-brown particulate	121.67067	10/12/2016 19:16	121.66451	10/9/2016 18:12	0.00580	195	No
			121.67067	10/13/2016 9:20	121.66489	10/10/2016 11:52			
			121.67082	10/13/2016 17:08	121.66500	10/10/2016 21:20			
R3	1005	Red-brown particulate	126.65455	10/12/2016 19:15	126.64520	10/9/2016 18:12	0.00891	170	No
			126.65459	10/13/2016 9:21	126.64569	10/10/2016 11:55			
			126.65473	10/13/2016 17:10	126.64581	10/10/2016 21:19			
R0	1015	Clean	127.35477	10/12/2016 19:09	127.35477	10/9/2016 17:57	-0.00025	150	No
			127.35478	10/13/2016 9:29	127.35491	10/10/2016 12:17			
			127.35499	10/13/2016 17:17	127.35536	10/10/2016 21:04			

#### REMARKS



Results of Gravimetric Particulate Analysis  
Pellet Indurating Furnace Line 2 - Stack 2 (SV027)

Test Date: 10/4-5/2016

Test 2 - Baseline

**Method 5 Particulate Mass Determination**

Inputs	Symbol	Units	Run 1	Run 2	Run 3	Blanks
Air Filter - Net Particulate Mass	$M_{af}$	g	0.01737	0.01597	0.01569	0.00016
Probe Wash - Net Residue Mass	$M_{pw}$	g	0.00658	0.00522	0.00619	-0.00025
Probe Wash Volume	$V_{pw}$	ml	175	140	175	150
<b>Calculations</b>						
Probe Wash Blank Correction Amount $C_{pw} = V_{pw} \times M_{pw(blank)} \div V_{pw(blank)}$	$C_{pw}$	g	0.00000	0.00000	0.00000	
Probe Wash Final Mass $M_{pwf} = M_{pw} - C_{pw}$	$M_{pwf}$	g	0.00658	0.00522	0.00619	
<b>Filterable Particulate Matter (PM) Mass</b> $M_{PM} = M_{af} + M_{pwf}$	$M_{PM}$	g	<b>0.02395</b>	<b>0.02119</b>	<b>0.02188</b>	



## LABORATORY REPORT

### PARTICULATE TESTING FRONT HALF GRAVIMETRIC RESULTS

CLIENT HTC

PROJECT NO. 23/69-1428.63 BASE-200

TEST T2-Baseline

TEST DATE 10/4-5/2016

SOURCE ID Line 2 SV027

SAMPLING LOCATION Stack B

SAMPLES COLLECTED BY JAR2

AIR FILTERS: 4 INCH GFF

ANALYZED ON:

ANALYSIS PERFORMED BY ROB

Run	Filter ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)
R1	4Q0607	Dark red particulate	0.79216	10/12/2016 19:36	0.77485	9/24/2016 15:09	0.01737
			0.79215	10/13/2016 9:42	0.77473	9/28/2016 22:23	
			0.79218	10/13/2016 17:41			
R2	4Q0606	Dark red particulate	0.79759	10/12/2016 19:34	0.78157	9/24/2016 15:10	0.01597
			0.79750	10/13/2016 9:44	0.78149	9/28/2016 22:22	
			0.79750	10/13/2016 17:39			
R3	4Q0608	Dark red particulate	0.78816	10/12/2016 19:32	0.77243	9/24/2016 15:08	0.01569
			0.78807	10/13/2016 9:46	0.77232	9/28/2016 22:24	
			0.78806	10/13/2016 17:36			
R0	4Q0615	Dark red particulate	0.77643	10/12/2016 19:29	0.77636	9/24/2016 15:40	0.00016
			0.77645	10/13/2016 9:49	0.77631	9/28/2016 22:45	
			0.77653	10/13/2016 17:47			

#### PROBE WASH: ACETONE

Run	Beaker ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)	Solvent Volume (ml)	Evidence of Sample Loss?
R1	1007	Red-brown particulate	126.64455	10/12/2016 19:12	126.63781	10/9/2016 18:09	0.00658	175	No
			126.64454	10/13/2016 9:26	126.63791	10/10/2016 11:58			
			126.64475	10/13/2016 17:14	126.63822	10/10/2016 21:16			
R2	1006	Red-brown particulate	127.43644	10/12/2016 19:13	127.43057	10/9/2016 18:11	0.00522	140	No
			127.43641	10/13/2016 9:22	127.43131	10/10/2016 11:57			
			127.43664	10/13/2016 17:12	127.43129	10/10/2016 21:15			
R3	1008	Red-brown particulate	125.02905	10/12/2016 19:10	125.02247	10/9/2016 18:08	0.00619	175	No
			125.02891	10/13/2016 9:27	125.02274	10/10/2016 12:00			
			125.02929	10/13/2016 17:15	125.02307	10/10/2016 21:14			
R0	1015	Clean	127.35477	10/12/2016 19:09	127.35477	10/9/2016 17:57	-0.00025	150	No
			127.35478	10/13/2016 9:29	127.35491	10/10/2016 12:17			
			127.35499	10/13/2016 17:17	127.35536	10/10/2016 21:04			

#### REMARKS

Results of Gravimetric Particulate Analysis  
Pellet Indurating Furnace Line 2 - Stack 1 (SV028)

Test Date: 10/3-4/2016

Test 1 - Baseline

**Method 5 Particulate Mass Determination**

Inputs	Symbol	Units	Run 1	Run 2	Run 3	Blanks
Air Filter - Net Particulate Mass	$M_{af}$	g	0.01594	0.01352	0.01481	0.00016
Probe Wash - Net Residue Mass	$M_{pw}$	g	0.00402	0.00523	0.00433	-0.00025
Probe Wash Volume	$V_{pw}$	ml	125	140	100	150
Calculations						
Probe Wash Blank Correction Amount $C_{pw} = V_{pw} \times M_{pw(blank)} \div V_{pw(blank)}$	$C_{pw}$	g	0.00000	0.00000	0.00000	
Probe Wash Final Mass $M_{pwf} = M_{pw} - C_{pw}$	$M_{pwf}$	g	0.00402	0.00523	0.00433	
<b>Filterable Particulate Matter (PM) Mass</b> $M_{PM} = M_{af} + M_{pwf}$	$M_{PM}$	g	<b>0.01996</b>	<b>0.01874</b>	<b>0.01913</b>	



## LABORATORY REPORT

### PARTICULATE TESTING FRONT HALF GRAVIMETRIC RESULTS

CLIENT HTC

PROJECT No. 23/69-1428.63 BASE-200

TEST T1-Baseline

TEST DATE 10/3-4/2016

SOURCE ID Line 2 SV028

SAMPLING LOCATION Stack A

SAMPLES COLLECTED BY JAR2

AIR FILTERS: 4 INCH GFF

ANALYZED ON:

ANALYSIS PERFORMED BY ROB

Run	Filter ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)
R1	4Q0600	Dark red particulate	0.79549	10/12/2016 19:43	0.77947	9/24/2016 15:15	0.01594
			0.79533	10/13/2016 9:52	0.77932	9/28/2016 22:15	
			0.79534	10/13/2016 17:33			
R2	4Q0601	Dark red particulate	0.78887	10/12/2016 19:44	0.77523	9/24/2016 15:15	0.01352
			0.78869	10/13/2016 9:52	0.77512	9/28/2016 22:16	
			0.78869	10/13/2016 17:34			
R3	4Q0602	Dark red particulate	0.78960	10/12/2016 19:38	0.77475	9/24/2016 15:14	0.01481
			0.78946	10/13/2016 9:56	0.77464	9/28/2016 22:17	
			0.78954	10/13/2016 17:26			
R0	4Q0615	Dark red particulate	0.77643	10/12/2016 19:29	0.77636	9/24/2016 15:40	0.00016
			0.77645	10/13/2016 9:49	0.77631	9/28/2016 22:45	
			0.77653	10/13/2016 17:47			

#### PROBE WASH: ACETONE

Run	Beaker ID	Description	Gross Weight	Date/Time	Tare Weight	Date/Time	Uncorrected Net Mass (g)	Solvent Volume (ml)	Evidence of Sample Loss?
R1	1012	Red-brown particulate	127.90518	10/12/2016 19:23	127.90053	10/9/2016 18:01	0.00402	125	No
			127.90517	10/13/2016 9:13	127.90110	10/10/2016 12:07			
			127.90528	10/13/2016 16:56	127.90132	10/10/2016 21:09			
R2	1001	Red-brown particulate	122.56753	10/12/2016 19:22	122.56192	10/9/2016 18:16	0.00523	140	No
			122.56747	10/13/2016 9:15	122.56213	10/10/2016 11:44			
			122.56756	10/13/2016 16:58	122.56245	10/10/2016 21:25			
R3	1002	Red-brown particulate	125.30735	10/12/2016 19:20	125.30267	10/9/2016 18:15	0.00433	100	No
			125.30740	10/13/2016 9:15	125.30305	10/10/2016 11:48			
			125.30750	10/13/2016 17:00	125.30320	10/10/2016 21:24			
R0	1015	Clean	127.35477	10/12/2016 19:09	127.35477	10/9/2016 17:57	-0.00025	150	No
			127.35478	10/13/2016 9:29	127.35491	10/10/2016 12:17			
			127.35499	10/13/2016 17:17	127.35536	10/10/2016 21:04			

#### REMARKS

# **Barr Engineering**

5150 W. 76<sup>th</sup> Street  
Edina, MN 55439-2330

Project Number: 23/69-1428.63 BASE 200

Mercury

Ontario Hydro Method Analysis

Analytical Report  
28342



Element One, Inc.

5022-C Wrightsville Av., Wilmington, NC 28403

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

The following data for Analytical Report 28342  
has been reviewed for completeness, accuracy,  
adherence to method protocol,  
and compliance with quality assurance guidelines.

Review by:



Linda Ann Webb, M.S. Chemist  
November 04, 2016

Report Reviewed and Finalized By:



Ken Smith, Laboratory Director  
November 04, 2016

# 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
-----	-----	-----	-----	-----	-----	-----	-----
Line 2 SVO28-R1	# 1	3.76	0.010	< 0.01	0.245	< 0.018	3.44
	# 2		0.009	< 0.01	0.243	< 0.018	3.57
Line 2 SVO28-R2	# 1	4.23	0.009	< 0.01	0.523	0.019	3.80
	# 2		0.008	< 0.01	0.519	0.018	3.57
Line 2 SVO28-R3	# 1	4.63	0.010	< 0.01	0.761	0.013	3.84
	# 2		0.010	< 0.01	0.768	0.013	3.85
Line 2 SVO27-R1	# 1	6.51	0.011	< 0.01	0.946	0.015	5.56
	# 2		0.012	< 0.01	0.919	0.016	5.55
Line 2 SVO27-R2	# 1	6.31	0.0128	< 0.01	0.895	0.017	5.50
	# 2		0.0128	< 0.01	0.891	0.017	5.28
Line 2 SVO27-R3	# 1	7.17	0.013	0.011	0.912	0.017	6.18
	# 2		0.013	0.011	0.902	0.016	6.27



## 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
-----	----	-----	-----	-----	-----	-----	-----
Line 2 SVO26–R1	# 1	12.6	0.016	< 0.01	1.38	0.030	11.0
	# 2		0.017	< 0.01	1.40	0.031	11.3
Line 2 SVO26–R2	# 1	13.2	0.012	< 0.01	1.41	0.027	11.7
	# 2		0.012	< 0.01	1.38	0.027	11.8
Line 2 SVO26–R3	# 1	12.4	0.006	< 0.01	1.31	0.036	11.0
	# 2		0.006	< 0.01	1.31	0.035	11.1
Line 2 SVO25–R1	# 1	16.0	< 0.005	< 0.01	1.38	0.041	14.5
	# 2		< 0.005	< 0.01	1.37	0.043	14.6
Line 2 SVO25–R2	# 1	12.1	0.006	< 0.01	1.23	0.0401	10.6
	# 2		0.005	< 0.01	1.21	0.0385	11.0
Line 2 SVO25–R3	# 1	18.1	0.007	< 0.01	1.41	0.0326	16.5
	# 2		0.007	< 0.01	1.38	0.0297	16.8

### Reagent Blank Summary of OHM Mercury Analysis

Run Number		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
-----	----	-----	-----	-----	-----	-----
Field Blank	#1	----	< 0.05	< 0.013	< 0.025	----
	#2	----	< 0.05	< 0.013	< 0.025	----
Reagent Blank	#1	< 0.005	< 0.01	< 0.05	0.033	0.369
	#2	< 0.005	< 0.01	< 0.05	0.032	0.383

# ANALYTICAL NARRATIVE

## Element One Analytical Narrative

Client:	Barr Engineering	Element One #:	28342
Client ID:	23/69-1428.63 BASE 200	Analyst:	LAW
Method:	OHM	Dates Received:	10/11 & 17/16
Analytes:	Hg	Dates Analyzed:	10/20-31/16

### 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 CVAF analyzer 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.

### 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 10; the spike recoveries for filter samples Line 2-SV028-R3, Line 2-SV027-R3, Line 2-SV026-R3 and Line 2-SV025-R3 were outside of laboratory guidelines of 85%-115%. Samples were reanalyzed at a two-fold dilution resulting in acceptable recoveries for Line 2-SV027-R3, Line 2-SV026-R3 and Line 2-SV025-R3. Sample Line 2-SV028-R3 filter resulted in improved, but not acceptable recoveries at the two-fold dilution. All filter samples were non-detect at the two-fold dilution; filter samples were reported at a one-fold dilution. The filter spike recoveries are summarized in the table below.

Run Number		Filter 1X	Filter 2X
-----	----	-----	-----
Line 2 SV028-R3	# 1	65%	84%
	# 2	63%	81%
Line 2 SV027-R3	# 1	69%	100%
	# 2	67%	102%
Line 2 SV026-R3	# 1	65%	101%
	# 2	63%	97%
Line 2 SV025-R3	# 1	64%	100%
	# 2	64%	102%

## **Element One Analytical Narrative cont.**

### **Analysis QA/QC**

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.

# QUALITY CONTROL SUMMARY

## Summary of Quality Control Data

### Mercury Duplicate Analysis RPD

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

Run Number	Filter	FH Rinse	KCl	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	KMnO <sub>4</sub>
-----	-----	-----	-----	-----	-----
Line 2 SV028-R1	9.1%	NA	0.8%	NA	3.5%
Line 2 SV028-R2	2.4%	NA	0.7%	3.8%	6.1%
Line 2 SV028-R3	3.0%	NA	0.9%	0.0%	0.2%
Line 2 SV027-R1	6.0%	NA	3.0%	7.9%	0.1%
Line 2 SV027-R2	0.0%	NA	0.4%	1.7%	4.2%
Line 2 SV027-R3	0.0%	0.9%	1.1%	2.4%	1.5%
Line 2 SV026-R1	6.3%	NA	0.9%	2.6%	3.3%
Line 2 SV026-R2	0.0%	NA	1.6%	0.0%	0.4%
Line 2 SV026-R3	1.8%	NA	0.5%	2.8%	0.9%
Line 2 SV025-R1	NA	NA	0.5%	3.8%	0.7%
Line 2 SV025-R2	3.6%	NA	1.4%	4.1%	4.1%
Line 2 SV025-R3	7.2%	NA	1.8%	9.3%	2.2%

### Mercury Triplicate Analysis RSD

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

Run Number	Filter	FH Rinse	KCl	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	KMnO <sub>4</sub>
-----	-----	-----	-----	-----	-----
Line 2 SV028-R2	1.4%	NA	8.7%	2.8%	3.5%
Line 2 SV027-R2	1.3%	NA	2.5%	1.8%	4.3%
Line 2 SV026-R2	0.5%	NA	2.0%	1.3%	0.3%
Line 2 SV025-R2	2.8%	NA	0.9%	3.3%	2.1%

### 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>
-----		-----	-----	-----	-----	-----
Line 2 SV028-R3	# 1	*65%	98%	102%	107%	99%
	# 2	*63%	97%	102%	105%	94%
Line 2 SV027-R3	# 1	*69%	95%	102%	102%	97%
	# 2	*67%	95%	104%	102%	97%
Line 2 SV026-R3	# 1	*65%	99%	104%	103%	109%
	# 2	*63%	98%	105%	102%	104%
Line 2 SV025-R3	# 1	*64%	97%	107%	92%	96%
	# 2	*64%	98%	109%	93%	97%

\*See Analytical Narrative, page 7.

# 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: 10020

COC 1 of 3

Check One:  
☒ Barr Engineering Company  
3128 14th Avenue East  
Hibbing, MN 55435-4803  
(218) 262-8600  
Project Contact: Tom LEIER  
(Print Name)  
TYL@BARR.COM  
(email)

☐ Barr Engineering Company  
5150 West 76th Street  
Edina, MN 55439-2330  
(952) 832-2600

Project Number 23/69-1428.63 BASE 200  
Barr Engineering Company  
Attn: Accounts Payable  
4300 Marketpointe Drive  
Minneapolis, MN 55435-4803  
Ph. (952) 832-2600 Fax (952) 832-2601  
28342

Special instructions and/or specific regulatory requirements:  
(method, limit of detection, etc.)

ONTARIO HYDRO  
at B Fractions 1 and 2a  
will be sent in  
separate shipment

Requested Due Date:

☒ Standard Turn  
Around Time  
☐ Rush  
(mm/dd/yyyy)

Sample Identification	Date/Time Collected	Media I.D. #	Type			METHOD										SAMPLE FRACTION		Total No. of Containers	Remarks
			Grab	Comp.	QC	ONTARIO HYDRO	234	ALERT	ALERT	ALERT	ALERT	ALERT	ALERT	ALERT	ALERT	ALERT	ALERT		
1. LINEZ SV028 R1	10/03/16 1600	420600	X		X													6	1001
2.   R2	10/03/16 1830	420601																	1002
3.   R3	10/04/16 1100	420602																	1003
4. LINEZ SV027 R1	10/04/16 1400	420607																	1004
5.   R2	10/04/16 1600	420606																	1005
6.   R3	10/05/16 1100	420608																	1006
7. LINE3 SV026 R1	10/03/16 1600	420603																	1007
8.   R2	10/03/16 1830	420604																	1008
9.   R3	10/04/16 1100	420605																	1009
10.																			1010

Collected by (Print Name): TOM LEIER / JOHN RAVEY  
Collector's Signature: [Signature] Date/Time: 10/10/16 14:00  
Laboratory: FARR 2-1  
Method of Shipment: ☐ Sampler ☒ FedEx ☐ UPS Other:  
Sample Condition upon Receipt: ☐ Acceptable ☐ Other (explain)  
Relinquished by: [Signature] Received by: [Signature] Date/Time: 10/10/16 14:00  
Received at Lab by: [Signature] Date/Time: 10-17-16 1030

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

Samples received in good condition. No empty containers. Version 2 - Created 06/01/14



## Barr Engineering Co. Chain of Custody



## Request for Laboratory Analytical Services

Sample Origination State:

☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other:  
☒ MN ☐ WI

COC Number: 10018

COC 2 of 3

Report Results To

Check One:

☒ Barr Engineering Company  
 3128 14th Avenue East  
 Hibbing, MN 55435-4803  
 (218) 262-8600

☐ Barr Engineering Company  
 5150 West 76th Street  
 Edina, MN 55439-2330  
 (952) 832-2600
Project Contact: TOM LEIER  
(Print Name)TYL@BARR.COM  
(email)

Send Invoice To

Project Number 23/69-1428.63 BASE 200

 Barr Engineering Company  
 Attn: Accounts Payable  
 4300 Marketpointe Drive  
 Minneapolis, MN 55435-4803  
 Ph. (952) 832-2600 Fax (952) 882-2601

28342

Special instructions and/or specific regulatory requirements:  
(method, limit of detection, etc.)Fractions 1 and 2a will be sent  
in separate shipment

Requested Due Date:

☒ Standard Turn  
 Around Time

☐ Rush  
 (mm/dd/yyyy)

Sample Identification	Date/Time Collected	Media I.D. #	Type			OUTALIO					FILTER (L)	Probe Base	Probe Base	KCL	HNO <sub>3</sub> -H <sub>2</sub> O	H <sub>2</sub> SO <sub>4</sub> -KNO <sub>3</sub>		Total No. of Containers	Remarks
			Grab	Comp.	QC														
1. LINE 2 SVD25 A1	10/04/16 1400	4Q06609	X		X						1	1	1	1	1	1		6	Reck # 1009
2.   A2	10/04/16 1600	4Q06610									1	1	1	1	1	1		1	1010
3.   A3	10/05/16 1100	4Q06611									1	1	1	1	1	1		1	1011
4. Field Blank	10/03/16 1600	4Q06615		X										1	1	1		3	1015
5. \		\																	\
6. Method Blanks		4Q06612		X														3	\
7. \		\																	\
8. \		\																	\
9. \		\																	\
10. \		\																	\

Chain of Custody	Collected by (Print Name): TOM LEIER / JOHN ROONEY	Relinquished by:	Received by:	Date/Time:
	Collector's Signature: <i>John Rooney</i>	Date/Time: 10/10/16 14:00	<i>John Rooney</i> <i>KBG</i> <i>BARR</i>	10/10/16 14:00
	Laboratory: <i>BARR - E-I</i>		<i>KBG</i> <i>BARR</i>	10/13/16 18:10
	Method of Shipment: <input type="checkbox"/> Sampler <input checked="" type="checkbox"/> FedEx <input type="checkbox"/> UPS Other:			
	Sample Condition upon Receipt: <input checked="" type="checkbox"/> Acceptable <input type="checkbox"/> Other (explain)	Received at Lab by:		
	<i>Per Tom Leier via phone, archive C1 &amp; C2 for FB - 228 10/18/16</i>	<i>Lucy Braton</i>		10/17/16 10:30

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

Version 2 - Created 06/07/14

Barr Engineering Co. Chain of Custody



Request for Laboratory Analytical Services

Sample Origination State:

☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other:  
☒ MN ☐ WI

COC Number: 10020

COC 1 of 3

Check One:

☒ Barr Engineering Company  
3128 14th Avenue East  
Hibbing, MN 55435-4803  
(218) 262-8600

☐ Barr Engineering Company  
5150 West 76th Street  
Edina, MN 55439-2330  
(952) 832-2600

Project Contact: TOM LEIER (Print Name) TYL@BARR.COM (email)

Project Number 23/69-1428.63 BASE 200

Send Invoice To: **Barr Engineering Company**  
Attn: Accounts Payable  
4300 Marketpointe Drive  
Minneapolis, MN 55435-4803  
Ph. (952) 832-2600 Fax (952) 832-2601

28342

Special instructions and/or specific regulatory requirements:  
(method, limit of detection, etc.)

\* Fractions 1 and 2  
ONTARIO HYDRO will be sent in  
separate shipment

Requested Due Date:  
☒ Standard Turn  
Around Time  
☐ Rush  
(mm/dd/yyyy)

Sample Identification	Date/Time Collected	Media I.D. #	Type	
			Grab	QC
1. LINE2 SV028 R1	10/03/16 1600	420600	X	X
2. R2	10/03/16 1830	420601		
3. R3	10/04/16 1100	420602		
4. LINE2 SV027 R1	10/04/16 1400	420607		
5. R2	10/04/16 1600	420606		
6. R3	10/05/16 1100	420608		
7. LINE3 SV026 R1	10/03/16 1600	420603		
8. R2	10/03/16 1830	420604		
9. R3	10/04/16 1100	420605		
10.				

METHOD		SAMPLE FRACTION					Total No. of Containers	Remarks
		1	2	3	4	5		
ONTARIO HYDRO								
EPA ALEDO								
FILTER (1)								
P&G R&W ALEDO (2)								
P&G R&W ALEDO (3)								
K&L Inorganic (4)								
H&D Inorganic (5)								
H&D Inorganic (6)								
H&D Inorganic (7)								
H&D Inorganic (8)								
H&D Inorganic (9)								
H&D Inorganic (10)								
H&D Inorganic (11)								
H&D Inorganic (12)								
H&D Inorganic (13)								
H&D Inorganic (14)								
H&D Inorganic (15)								
H&D Inorganic (16)								
H&D Inorganic (17)								
H&D Inorganic (18)								
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H&D Inorganic (22)								
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H&D Inorganic (25)								
H&D Inorganic (26)								
H&D Inorganic (27)								
H&D Inorganic (28)								
H&D Inorganic (29)								
H&D Inorganic (30)								
H&D Inorganic (31)								
H&D Inorganic (32)								
H&D Inorganic (33)								
H&D Inorganic (34)								
H&D Inorganic (35)								
H&D Inorganic (36)								
H&D Inorganic (37)								
H&D Inorganic (38)								
H&D Inorganic (39)								
H&D Inorganic (40)								
H&D Inorganic (41)								
H&D Inorganic (42)								
H&D Inorganic (43)								
H&D Inorganic (44)								
H&D Inorganic (45)								
H&D Inorganic (46)								
H&D Inorganic (47)								
H&D Inorganic (48)								
H&D Inorganic (49)								
H&D Inorganic (50)								
H&D Inorganic (51)								
H&D Inorganic (52)								
H&D Inorganic (53)								
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H&D Inorganic (96)								
H&D Inorganic (97)								
H&D Inorganic (98)								
H&D Inorganic (99)								
H&D Inorganic (100)								

Chain of Custody

Collected by (Print Name): TOM LEIER / JOHN RAVEY

Collector's Signature: John Ravey Date/Time: 10/10/16 14:00

Laboratory: ELEMENT 1

Method of Shipment: ☐ Sampler ☒ FedEx ☐ UPS Other: \_\_\_\_\_

Sample Condition upon Receipt: ☐ Acceptable ☐ Other (explain) \_\_\_\_\_

Relinquished by: John Ravey Received by: Pete Hamilton Date/Time: 10/10/16 1230

Received at Lab by: Loa Braton Date/Time: 10-11-16 0955

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

Version 2 - Created 06/01/14

Barr Engineering Co. Chain of Custody



Request for Laboratory Analytical Services

Sample Origination State:

☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other:  
☒ MN ☐ WI

COC Number: 10018

COC 2 of 3

Check One:

☒ Barr Engineering Company  
3128 14th Avenue East  
Hibbing, MN 55435-4803  
(218) 262-8600

☐ Barr Engineering Company  
5150 West 76th Street  
Edina, MN 55439-2330  
(952) 832-2600

Project Contact: TOM LEIER (Print Name) TYL @ BARR.COM (email)

Project Number 23 / 69 - 1428.63 BASE 200

Barr Engineering Company  
Attn: Accounts Payable  
4300 Marketpointe Drive  
Minneapolis, MN 55435-4803  
Ph. (952) 832-2600 Fax (952) 882-2601

28342

Special instructions and/or specific regulatory requirements:  
(method, limit of detection, etc.)  
Fractions 1 and 2a will be sent  
in separate shipment

Requested Due Date:

☒ Standard Turn  
Around Time  
☐ Rush  
(mm/dd/yyyy)

Sample Identification	Date/Time Collected	Media I.D. #	Type			METHOD	SAMPLE FRACTION										Total No of Containers	Remarks
			Grab	Comp.	QC													
1. LINE 2 SVD25 A1	10/04/16 1400	4Q609	X		X	ONTARIO HYDRO												
2. A2	10/04/16 1600	4Q0610																
3. A3	10/05/16 1100	4Q0611																
4. Field Blank	10/03/16 1600	4Q06																
5.																		
6.																		
7.																		
8.																		
9.																		
10.																		

Collected by (Print Name): TOM LEIER / JOHN ROONEY

Collector's Signature: John Rooney Date/Time: 10/10/16 14:00

Laboratory: ELEMENT 1

Method of Shipment: ☐ Sampler ☒ FedEx ☐ UPS Other:

Sample Condition upon Receipt: ☐ Acceptable ☐ Other (explain)

Relinquished by: John Rooney Date/Time: 10/10/16 1230

Received by: Pete Hamble

Received at Lab by: Lexa Braton 10-11-16 0955

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

Version 2 - Created 05/01/14

Barr Engineering Co. Chain of Custody



Request for Laboratory Analytical Services

Sample Origination State:

☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other:  
☒ MN ☐ WI

COC Number: 10019

COC 3 of 3

Check One:

☒ Barr Engineering Company  
 3128 14th Avenue East  
 Hibbing, MN 55435-4803  
 (218) 262-8600

☐ Barr Engineering Company  
 5150 West 76th Street  
 Edina, MN 55439-2330  
 (952) 832-2600

Project Contact: TOM LEIER (Print Name) TYL@BARR.COM (email)

Project Number 23 / 69 - 1428.63 BASE 200

28342

Barr Engineering Company  
 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.)		Requested Due Date:		METHOD										SAMPLE FRACTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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# ANALYTICAL DATA

elementOne

## AIR TESTING SAMPLE SUBMISSION FORM

Lab ID 28342

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Analysis Due Date 10.25.16  
QA/QC/Report Due Date 10.27.16

Client: Barr Engineering
Project No 23/69-1428.63 BASE 200

Date Rec 10.11 & 17.16
Time Rec 0955 & 1030

HNO <sub>3</sub> Lot:	BrK Lot:	Volume Marked <u>Y</u> / N	Ref. Method: OHM
HF Lot:	KBrO <sub>3</sub> Lot:	Volume Loss Y / <u>N</u> ?	
HCl Lot:		pH < 2.0 Y / N	

## Sample Identification

1	Line 2 SVO28-OHM-R1	7	Line 2 SVO26-OHM-R1	13	Field Blank
2	Line 2 SVO28-OHM-R2	8	Line 2 SVO26-OHM-R2	14	Reagent Blank – Page 2
	Line 2 SVO28-OHM-R2 Triplicate		Line 2 SVO26-OHM-R2 Triplicate		
3	Line 2 SVO28-OHM-R3	9	Line 2 SVO26-OHM-R3		
	Line 2 SVO28-OHM-R3 Spike		Line 2 SVO26-OHM-R3 Spike		
4	Line 2 SVO27-OHM-R1	10	Line 2 SVO25-OHM-R1		
5	Line 2 SVO27-OHM-R2	11	Line 2 SVO25-OHM-R2		
	Line 2 SVO27-OHM-R2 Triplicate		Line 2 SVO25-OHM-R2 Triplicate		
6	Line 2 SVO27-OHM-R3	12	Line 2 SVO25-OHM-R3		
	Line 2 SVO27-OHM-R3 Spike		Line 2 SVO25-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)	
	pH <2.0 Y / N		pH <2.0 <u>Y</u> / N		pH <2.0 <u>Y</u> / N		pH <2.0 <u>Y</u> / N		pH <2.0 <u>Y</u> / N	
Lab ID.	Fil ID	BV, ml	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml
1			136	200	480	500	134	250	480	500
2.T			90		550	600	138		590	600
3.S			108		560	600	132		590	600
4			110		580	600	140		620	700
5.T			100		590	600	140		680	700
6.S			72		570	600	134		550	600
7			100		600	700	142		520	600
8.T			80		610	700	148		540	600
9.S			122		650	700	128		620	700
10			112		670	700	142		610	700
11.T			70		670	700	140		640	700
12.S			134		670	700	140		650	700
13					490	500	134		440	500

## Lab Communications

Rec Runs: C1, C2a, C2, C3, C4, C5; RB: C12, C7, C8, C9, C10, C11—10.18.16 LLB

Page 1 of 2

10/18/2016 12:43:35 PM

SS Form By LLBLabeled By/Date LLB 10/18/16C1 Prep By/Date LLB 10-28-16 C4 Prep By/Date LLB 10-20-16C2 Prep By/Date LLB 10-19-16 C5 Prep By/Date LLB 10-24-16C3 Prep By/Date LLB 10-19-16 C2a Prep By/Date LLB 10-19-16ID Verification By/Date LLB 10-18-16

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28342 Barr OHM Report Packet

Page 18 of 31

# AIR TESTING SAMPLE SUBMISSION FORM

Lab ID 28342

\_\_\_\_\_

Analysis	Due Date	10.25.16
QA/QC/Report	Due Date	10.27.16

Client:	Barr Engineering
Project No	23/69-1428.63 BASE 200

Date Rec	10.11 & 17.16
Time Rec	0955 & 1030

HNO <sub>3</sub> Lot:	BrK Lot:	Volume Marked Y / N	Ref. Method: OHM
HF Lot:	KBrO <sub>3</sub> Lot:	Volume Loss Y / N / ?	
HCl Lot:		pH < 2.0 Y / N	

### Sample Identification

14	Reagent Blank				

Analyses Requested	Sample 14	Hg
--------------------	-----------	----

## Reagent Blank

Lab ID	**MC	Fraction	pH	BV, ml	FV, ml	Comments
14.1	C12	Filter Blank				
14.2	C7	0.1N HNO <sub>3</sub>	~2	56	56	
14.3	C8	1.0 N KCl	~2	54	54	
14.4	C9	5% HNO <sub>3</sub> / 10% H <sub>2</sub> O <sub>2</sub>	~2	50	50	
14.5	C10	KMnO <sub>4</sub> / H <sub>2</sub> SO <sub>4</sub>	~2	45	45	
14.6	C11	10% NH <sub>2</sub> OH.HCl or	~2	100	100	
		10% HNO <sub>3</sub>				

## Lab Communications

[illegible]

Page 2 of 2  
10/18/2016 12:29:54 PM  
SS Form By LB  
Labeled By/Date

C1 Prep By/Date DAN 10.28.16 C4 Prep By/Date LAW 10.20.16  
C2 Prep By/Date LAW 10.19.16 C5 Prep By/Date LAW 10.24.16  
C3 Prep By/Date LAW 10.19.16 C2a Prep By/Date LAW 10.19.16  
ID Verification By/Date VS 10.18.16

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## MERCURY BATCH DIGESTION/RUN WORKSHEET

Date Prepared & Digested: 10-20-16 Initials: UW Start Time: 11:30 Stop Time: 12:30

Using the Method Reagent Blank and the 0.4ug/ml Working, QC #2 &amp; QC #3 Standards, make the following dilutions for the calibration and QC's...

A/S	Curve & QC's	ml working std	40 ml aliquot concentration	Final Vol	Working Standard Lot Numbers
7	Reagent BLK	0	0.0	400	<b>#1 (working std):</b> Lot #: <u>Hg2-047-1</u> by: <u>D4m</u> <b>QC #2 &amp; #3 are made the same as WS #1 (0.4ug/ml)</b> QC Std #2 Lot #: <u>Hg2-047-2</u> QC Std #3 (QC #3): Lot #: <u>Hg2-047-3</u>
8	0.001 ug, DL	0.025mL	0.000025	400	
9	0.002 ug	0.025ml	0.00005	200	
10	0.004ug	0.050ml	0.0001	200	
11	0.020ug	0.250ml	0.0005	200	
12	0.040ug	0.500ml	0.0010	200	
13	0.02ug=QC#2	0.5ml QC#2 std	0.00050	400	
14	0.02ug=QC#3	0.5ml QC#3 std	0.00050	400	Curve prepared by: <u>UW</u> OHM-030-4 → curve lot # Comments: <u>102016-1M</u>

A/S	LAB #	ml used	Sample FV, ml	Dilutions	Spike ug	Client
15	<u>28342-1.2</u>	<u>20</u>	<u>200</u>			
16	<u>-2.2</u>					
17	<u>-2.2 Trip</u>					
18	<u>-3.2</u>					
19	<u>-3.2+</u>					
20	<u>-4.2</u>					
21	<u>-5.2</u>					
22	<u>-5.2 Trip</u>					
23	<u>-6.2</u>					
24	<u>-6.2+</u>					

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion**Spike for Hg,** Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample.**Digestion:** To the sample add... 5ml of 33% HCL, 1ml Potassium Bromate / Potassium Bromide solution and let stand for 30minHNO<sub>3</sub> Lot # 11110020 HCL Lot# 4115050 Hydrox Lot# Hg2-039-5

Clear samples after digestion with 0.1ml of Hydroxylamine solution.

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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28342 Barr OHM Report Packet

Page 20 of 31



A/S	LAB #	ml used	Sample FV, ml	Times to run	Dilutions	Spike ug	Client
25	28342-7.2	20	200				
26	-8.2						
27	-8.2 Trp						
28	-9.2						
29	-9.2+						
30	-10.2						
31	-11.2						
32	-11.2 Trp						
33	-12.2						
34	-12.2+						
35	-13.2-14.2						
36	28342.1.3	10	500				
37	-2.3		600				
38	-2.3 Trp						
39	-3.3		600				
40	-3.3+						
41	-4.3						
42	-5.3						
43	-5.3 Trp						
44	-6.3						
45	-6.3+						
46	-7.3		700				
47	-8.3						
48	-8.3 Trp						
49	-9.3						
50	-9.3+						
51	-10.3						
52	-11.3						
53	-11.3 Trp						
54	-12.3						
55	-12.3+						
56	-13.3		500				
57	-14.3		500				

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

A/S	LAB #	ml used	Sample FV, ml	Times to run	Dilutions	Spike ug	Client
58	28342-1.4	20	250				
59	-2.4						
60	-2.4 Trp						
61	-3.4						
62	-3.4 +						
63	-4.4						
64	-5.4						
65	-5.4 Trp						
66	-6.4						
67	-6.4 +						
68	-7.4						
69	-8.4						
15	-8.4 Trp						
16	-9.4						
17	-9.4 +						
18	-10.4						
19	-11.4						
20	-11.4 Trp						
21	-12.4						
22	-12.4 +						
23	-13.4						
24	-14.4						
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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## MERCURY BATCH DIGESTION/RUN WORKSHEET

Date Prepared & Digested: 10-24-16 Initials: LAW Start Time: 11:00 Stop Time: 12:00

Using the Method Reagent Blank and the 0.4ug/ml Working, QC #2 &amp; QC #3 Standards, make the following dilutions for the calibration and QC's...

A/S	Curve & QC's	ml working std	40 ml aliquot concentration		Final Vol	Working Standard Lot Numbers	
7	Reagent BLK	0	0.0		400	#1 (working std): Lot #: Hg2-047-1 by: <u>DAM</u>	
8	0.001 ug, DL	0.025mL	0.000025		400	QC #2 & #3 are made the same as WS #1 (0.4ug/ml)	
9	0.002 ug	0.025ml	0.00005		200	QC Std #2	
10	0.004ug	0.050ml	0.0001		200	Lot #: <u>Hg2-047-2</u>	
11	0.020ug	0.250ml	0.0005		200	QC Std #3 (QC #3):	
12	0.040ug	0.500ml	0.0010		200	Lot #: <u>Hg2-047-3</u>	
13	0.02ug=QC#2	0.5ml QC#2 std	0.00050		400	Curve prepared by: <u>LAW</u>	
14	0.02ug=QC#3	0.5ml QC#3 std	0.00050		400	Comments: <u>102416-1M</u>	
A/S	LAB #	ml used	Sample FV, ml		Dilutions	Spike ug	Client
15	28342-6.3	10	600				
16	-6.3t	↓	↓				
17	-12.3	↓	700				
18	-12.3t	↓	↓				
19	28342-2.4	20	250				
20	-2.4Trip	↓	↓				
21	-5.4	↓	↓				
22	-5.4Trip	↓	↓				
23	-8.4	↓	↓				
24	-8.4Trip	↓	↓				

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion**Spike for Hg,** Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample.**Digestion:** To the sample add... 5ml of 33% HCL, 1ml Potassium Bromate / Potassium Bromide solution and let stand for 30minHNO<sub>3</sub> Lot # 111620 HCL Lot# 4116020 Hydrox Lot# Hg2-039-5

Clear samples after digestion with 0.1ml of Hydroxylamine solution.

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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28342 Barr OHM Report Packet

Page 23 of 31

A/S	LAB #	ml used	Sample FV, ml	Times to run	Dilutions	Spike ug	Client
25	28342-11.4	250 20	250				
26	-11.4 <i>rep</i>	↓	↓				
27	-12.4	↓	↓				
28	-12.4 <i>+</i>	↓	↓				
29	-13.4	↓	↓				
30	-14.4	↓	↓				
31	28342-1.5	20	500				
32	-2.5	↓	600				
33	-2.5 <i>rep</i>	↓	↓				
34	-3.5	↓	600				
35	-3.5 <i>+</i>	↓	↓				
36	-4.5	↓	700				
37	-5.5	↓	↓				
38	-5.5 <i>rep</i>	↓	↓				
39	-6.5	↓	600				
40	-6.5 <i>+</i>	↓	↓				
41	-7.5	↓	↓				
42	-8.5	↓	↓				
43	-8.5 <i>rep</i>	↓	↓				
44	-9.5	↓	700				
45	-9.5 <i>+</i>	↓	↓				
46	-10.5	↓	↓				
47	-11.5	↓	↓				
48	-11.5 <i>rep</i>	↓	↓				
49	-12.5	↓	↓				
50	-12.5 <i>+</i>	↓	↓				
51	-13.5	↓	500				
52	-14.5	↓	↓				
53	-14.6	↓	↓				
54							
55							
56							
57							

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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## MERCURY BATCH DIGESTION/RUN WORKSHEET

Date Prepared & Digested: 10-25-16 Initials: UW Start Time: 8:30 Stop Time: 9:30

Using the Method Reagent Blank and the 0.4ug/ml Working, QC #2 &amp; QC #3 Standards, make the following dilutions for the calibration and QC's...

A/S	Curve & QC's	ml working std	40 ml aliquot concentration	Final Vol	Working Standard Lot Numbers
7	Reagent BLK	0	0.0	400	<b>#1 (working std):</b> Lot #: <u>Hg 2-047-1</u> by: <u>DM</u> <b>QC #2 &amp; #3 are made the same as WS #1 (0.4ug/ml)</b> QC Std #2 Lot #: <u>Hg 2-047-2</u> QC Std #3 (QC #3): Lot #: <u>Hg 2-047-3</u>
8	0.001 ug, DL	0.025ml	0.000025	400	
9	0.002 ug	0.025ml	0.00005	200	
10	0.004ug	0.050ml	0.0001	200	
11	0.020ug	0.250ml	0.0005	200	
12	0.040ug	0.500ml	0.0010	200	
<b>13</b>	0.02ug=QC#2	0.5ml QC#2 std	0.00050	400	
<b>14</b>	0.02ug=QC#3	0.5ml QC#3 std	0.00050	400	Curve prepared by: <u>UW</u> Comments: <u>1025(b-1M)</u>

A/S	LAB #	ml used	Sample FV, ml	Dilutions	Spike ug	Client
15	<u>28342-13.5</u>	<u>20</u>	<u>500</u>			
16	<u>-14.5</u>	<u>20</u>	<u>500</u>			
17	<u>-14.6</u>	<u>20</u>	<u>500</u>			
18	<u>-11.4</u>	<u>20</u>	<u>250</u>			
19	<u>-11.4 trip</u>	<u>↓</u>	<u>↓</u>			
20	<u>-12.4</u>	<u>20</u>	<u>250</u>			
21	<u>-12.4 +</u>	<u>↓</u>	<u>↓</u>			
22	<u>-13.4</u>	<u>20</u>	<u>250</u>			
23	<u>-14.4</u>	<u>↓</u>	<u>↓</u>			
24	<u>-13.5</u>	<u>20</u>	<u>500</u>			

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion**Spike for Hg,** Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample.**Digestion:** To the sample add... 5ml of 33% HCL, 1ml Potassium Bromate / Potassium Bromide solution and let stand for 30minHNO<sub>3</sub> Lot # 116020 HCL Lot# 111620 Hydrox Lot# Hg 2039-5

Clear samples after digestion with 0.1ml of Hydroxylamine solution.

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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28342 Barr OHM Report Packet

Page 25 of 31

A/S	LAB #	ml used	Sample FV, ml	Times to run	Dilutions	Spike ug	Client
25	<del>28342</del> <del>14.5</del>	<del>20</del>	<del>500</del>				
26	<del>28342</del> <del>1.5</del>	<del>4</del>	<del>500</del>				
27	-2.5		600				
28	-2.5 Strp		↓				
29	-3.5		600				
30	-3.5+		↓				
31	-4.5		700				
32	-5.5		700				
33	-5.5 Strp		↓				
34	-6.5		600				
35	-6.5+		↓				
36	-7.5		600				
37	-8.5		600				
38	-8.5 Strp		↓				
39	-9.5		700				
40	-9.5+		↓				
41	-10.5		700				
42	-11.5		700				
43	-11.5 Strp		↓				
44	-12.5		700				
45	-12.5+	✓	↓				
46							
47							
48							
49							
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51							
52							
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54							
55							
56							
57							

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## MERCURY BATCH DIGESTION/RUN WORKSHEET

Date Prepared & Digested: 10-26-16 Initials: LAW Start Time: 8:15 Stop Time: 9:15

Using the Method Reagent Blank and the 0.4ug/ml Working, QC #2 &amp; QC #3 Standards, make the following dilutions for the calibration and QC's...

A/S	Curve & QC's	ml working std	40 ml aliquot concentration	Final Vol	Working Standard Lot Numbers
7	Reagent BLK	0	0.0	400	<b>#1 (working std):</b> Lot #: <u>Hg 2-047-1</u> by: <u>DAM</u> <b>QC #2 &amp; #3 are made the same as WS #1 (0.4ug/ml)</b> QC Std #2 Lot #: <u>Hg 2-047-2</u> QC Std #3 (QC #3): Lot #: <u>Hg 2-047-3</u>
8	0.001 ug, DL	0.025mL	0.000025	400	
9	0.002 ug	0.025ml	0.00005	200	
10	0.004ug	0.050ml	0.0001	200	
11	0.020ug	0.250ml	0.0005	200	
12	0.040ug	0.500ml	0.0010	200	
13	0.02ug=QC#2	0.5ml QC#2 std	0.00050	400	
14	0.02ug=QC#3	0.5ml QC#3 std	0.00050	400	Curve prepared by: <u>LAW</u> Comments: _____ <u>102616-1M</u>

A/S	LAB #	ml used	Sample FV, ml	Dilutions	Spike ug	Client
15	28342-12.4	20	250			
16	-12.4+	↓	↓			
17	28342-6.5	2	600			
18	-6.5+	↓	↓			
19	-8.5	1	600			
20	-8.5+	↓	↓			
21	-9.5	↓	700			
22	-9.5+	↓	↓			
23	-10.5	↓	700			
24	-11.5	↓	700			

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion**Spike for Hg,** Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample.**Digestion:** To the sample add... 5ml of 33% HCL, 1ml Potassium Bromate / Potassium Bromide solution and let stand for 30minHNO<sub>3</sub> Lot # 1116020 HCL Lot# 1116020 Hydrox Lot# 11g2039-5

Clear samples after digestion with 0.1ml of Hydroxylamine solution.

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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28342 Barr OHM Report Packet

Page 27 of 31

A/S	LAB #	ml used	Sample FV, ml	Times to run	Dilutions	Spike ug	Client
25	28342-11.5	1	700				
26	-12.5	↓	↓				
27	-12.5	↓	↓				
28	28342-75	2	600				
29							
30							
31							
32							
33							
34							
35							
36							
37							
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Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet



## MERCURY BATCH DIGESTION/RUN WORKSHEET

Date Prepared & Digested: 102816 Initials: Law Start Time: 9:50 Stop Time: 10:50

Using the Method Reagent Blank and the 0.4ug/ml Working, QC #2 &amp; QC #3 Standards, make the following dilutions for the calibration and QC's...

A/S	Curve & QC's	ml working std	40 ml aliquot concentration		Final Vol	Working Standard Lot Numbers	
7	Reagent BLK	0	0.0		400	<b>#1 (working std):</b> Lot #: <u>Hg2-047-1</u> by: <u>Law</u> <b>QC #2 &amp; #3 are made the same as WS #1 (0.4ug/ml)</b> QC Std #2 Lot #: <u>Hg2-047-2</u> QC Std #3 (QC #3): Lot #: <u>Hg2-047-3</u>	
8	0.001 ug, DL	0.025mL	0.000025		400		
9	0.002 ug	0.025ml	0.00005		200		
10	0.004ug	0.050ml	0.0001		200		
11	0.020ug	0.250ml	0.0005		200		
12	0.040ug	0.500ml	0.0010		200		
13	0.02ug=QC#2	0.5ml QC#2 std	0.00050		400		
14	0.02ug=QC#3	0.5ml QC#3 std	0.00050		400	Curve prepared by: <u>Law</u> Comments: _____ <u>102816-1M</u> _____ _____	
A/S	LAB #	ml used	Sample FV, ml		Dilutions	Spike ug	Client
15	<u>28342-12.5</u>	<u>1</u>	<u>700</u>				
16	<u>-12.5</u>	<u>↓</u>	<u>↓</u>				
17	<u>28342 L2BFIL</u>	<u>10</u>	<u>50</u>				
18	<u>-L2BFIL</u>	<u>0.4</u>	<u>↓</u>				
19	<u>-1.1</u>	<u>10</u>	<u>↓</u>				
20	<u>-2.1</u>	<u>↓</u>	<u>↓</u>				
21	<u>-2.1 tip</u>	<u>↓</u>	<u>↓</u>				
22	<u>-3.1</u>	<u>↓</u>	<u>↓</u>				
23	<u>-3.1</u>	<u>↓</u>	<u>↓</u>				
24	<u>-4.1</u>	<u>↓</u>	<u>↓</u>				

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion**Spike for Hg,** Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample.**Digestion:** To the sample add... 5ml of 33% HCL, 1ml Potassium Bromate / Potassium Bromide solution and let stand for 30minHNO<sub>3</sub> Lot # 1116020 HCL Lot# 9116020 Hydrox Lot# Hg2-039-5

Clear samples after digestion with 0.1ml of Hydroxylamine solution.

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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## MERCURY BATCH DIGESTION/RUN WORKSHEET

Date Prepared & Digested: 10-31-16 Initials: LMW Start Time: 11:00 Stop Time: 12:00

Using the Method Reagent Blank and the 0.4ug/ml Working, QC #2 &amp; QC #3 Standards, make the following dilutions for the calibration and QC's...

A/S	Curve & QC's	ml working std	40 ml aliquot concentration	Final Vol	Working Standard Lot Numbers
7	Reagent BLK	0	0.0	400	<b>#1 (working std):</b> Lot #: <u>Hg2-051-1</u> by: <u>LMW</u> <b>QC #2 &amp; #3 are made the same as WS #1 (0.4ug/ml)</b> QC Std #2 Lot #: <u>Hg2-051-2</u> QC Std #3 (QC #3): Lot #: <u>Hg2-051-3</u>
8	0.001 ug, DL	0.025mL	0.000025	400	
9	0.002 ug	0.025ml	0.00005	200	
10	0.004ug	0.050ml	0.0001	200	
11	0.020ug	0.250ml	0.0005	200	
12	0.040ug	0.500ml	0.0010	200	
13	0.02ug=QC#2	0.5ml QC#2 std	0.00050	400	
14	0.02ug=QC#3	0.5ml QC#3 std	0.00050	400	Curve prepared by: <u>LMW</u> Comments: <u>103116-1LM</u>

A/S	LAB #	ml used	Sample FV, ml	Dilutions	Spike ug	Client
15	28342-3.1	5	50			
16	-3.1+	↓	↓			
17	-6.1	↓	↓			
18	-6.1+	↓	↓			
19	-9.1	↓	↓			
20	-9.1+	↓	↓			
21	-12.1	↓	↓			
22	-12.1+	↓	↓			
23						
24						

**NOTES:** Lab blanks and spikes must be prepared with each batch digestion**Spike for Hg,** Use calibration working 0.4ug/ml standard at the rate of 0.050ml per 40ml sample.**Digestion:** To the sample add... 5ml of 33% HCL, 1ml Potassium Bromate / Potassium Bromide solution and let stand for 30minHNO<sub>3</sub> Lot # 11110020 HCL Lot# H116020 Hydrox Lot# Hg2-046-11

Clear samples after digestion with 0.1ml of Hydroxylamine solution.

Element One, Inc Form 112 R2-Ontario Hydro Digestion Sheet

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28342 Barr OHM Report Packet

Page 30 of 31

## PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
0		0	3.078269	153.427521	0.172944	0	0	----	----	10/20/2016 15:55
0.001		0.001	23.791727	1141.302612	0.279479	20713.45898	3.078268	----	----	10/20/2016 15:57
0.002		0.002	43.969608	2040.967896	-0.049471	20445.66992	3.16753	----	----	10/20/2016 15:59
0.004		0.004	82.082237	3828.564697	-0.473054	19708.18945	3.741129	----	----	10/20/2016 16:01
0.02		0.02	402.858124	18885.59961	-1.118192	19970.96875	3.312768	----	----	10/20/2016 16:04
0.04		0.04	813.865112	38499.02344	-1.685886	20236.31836	2.301959	----	----	10/20/2016 16:06
Blk		0	1.706247	-217.203354	-1.706247	20236.31836	2.301959	1	1	10/20/2016 16:09
DL		0.0011	24.101059	1107.225952	0.111037	20236.31836	2.301959	1	1	10/20/2016 16:11
QC 2		0.0201	408.831329	19287.10938	0.036216	20236.31836	2.301959	1	1	10/20/2016 16:13
QC 3		0.0208	422.686829	20030.76953	-0.877393	20236.31836	2.301959	1	1	10/20/2016 16:16
Blk		0	1.802158	-207.554092	-1.802158	20236.31836	2.301959	1	1	10/20/2016 16:19
28342-1.2	#1	0.0051	12.676682	612.365906	0.076103	20236.31836	2.301959	20	200	10/20/2016 16:21
28342-1.2	#2	0.0035	9.428756	433.511841	-0.017974	20236.31836	2.301959	20	200	10/20/2016 16:23
28342-2.2	#1	0.008	18.474329	864.307068	-0.013116	20236.31836	2.301959	20	200	10/20/2016 16:25
28342-2.2	#2	0.0075	17.506552	785.918152	-0.263875	20236.31836	2.301959	20	200	10/20/2016 16:27
28342-2.2 TRP	#1	0.0066	15.662334	714.378052	-0.061612	20236.31836	2.301959	20	200	10/20/2016 16:30
28342-2.2 TRP	#2	0.0067	15.795998	711.228149	-0.031464	20236.31836	2.301959	20	200	10/20/2016 16:32
28342-3.2	#1	0.0023	6.912147	306.699768	-0.15763	20236.31836	2.301959	20	200	10/20/2016 16:34
28342-3.2	#2	0.0026	7.52711	338.979919	-0.075999	20236.31836	2.301959	20	200	10/20/2016 16:36
28342-3.2 SPK	#1	0.1967	400.341522	19215.02344	-0.182331	20236.31836	2.301959	20	200	10/20/2016 16:38
28342-3.2 SPK	#2	0.1946	396.099457	18836.04688	-0.96195	20236.31836	2.301959	20	200	10/20/2016 16:41
28342-4.2	#1	0	1.596135	-236.022461	-1.596135	20236.31836	2.301959	20	200	10/20/2016 16:44
28342-4.2	#2	0.0008	3.836107	167.193298	-0.051737	20236.31836	2.301959	20	200	10/20/2016 16:46
28342-5.2	#1	0.0042	10.86023	515.831909	-0.277925	20236.31836	2.301959	20	200	10/20/2016 16:48
28342-5.2	#2	0.0038	10.056828	451.854858	-0.02419	20236.31836	2.301959	20	200	10/20/2016 16:50
28342-5.2 TRP	#1	0.005	12.399435	571.647766	0.252283	20236.31836	2.301959	20	200	10/20/2016 16:52
28342-5.2 TRP	#2	0.005	12.427467	567.999512	-0.204918	20236.31836	2.301959	20	200	10/20/2016 16:55
28342-6.2	#1	0.011	24.526522	1142.315308	-0.266809	20236.31836	2.301959	20	200	10/20/2016 16:57
28342-6.2	#2	0.0109	24.289141	1088.579834	-0.524202	20236.31836	2.301959	20	200	10/20/2016 16:59
28342-6.2 SPK	#1	0.2014	409.960724	19649.11523	-0.598045	20236.31836	2.301959	20	200	10/20/2016 17:01
28342-6.2 SPK	#2	0.2003	407.584351	19570.3457	-1.163179	20236.31836	2.301959	20	200	10/20/2016 17:04
QC 2		0.0188	381.840576	18011.25977	-0.490385	20236.31836	2.301959	1	1	10/20/2016 17:09
QC 3		0.0196	398.598907	18954.06836	-1.242289	20236.31836	2.301959	1	1	10/20/2016 17:11
Blk		0	1.480648	-255.340469	-1.480648	20236.31836	2.301959	1	1	10/20/2016 17:14
28342-7.2	#1	0.003	8.471971	394.60321	-0.034089	20236.31836	2.301959	20	200	10/20/2016 17:16
28342-7.2	#2	0.0026	7.599027	328.197113	0.032565	20236.31836	2.301959	20	200	10/20/2016 17:18
28342-8.2	#1	0.0037	9.705674	435.1521	-0.290063	20236.31836	2.301959	20	200	10/20/2016 17:21
28342-8.2	#2	0.0036	9.668309	460.33548	0.333171	20236.31836	2.301959	20	200	10/20/2016 17:23
28343-8.2 TRP	#1	0.0048	11.962341	561.527771	0.089668	20236.31836	2.301959	20	200	10/20/2016 17:25
28343-8.2 TRP	#2	0.0049	12.197742	552.504578	-0.307125	20236.31836	2.301959	20	200	10/20/2016 17:27
283432-9.2	#1	0.0043	11.03457	501.978607	-0.004617	20236.31836	2.301959	20	200	10/20/2016 17:29
283432-9.2	#2	0.0042	10.747135	498.255707	-0.176983	20236.31836	2.301959	20	200	10/20/2016 17:32
28342-9.2 SPK	#1	0.1987	404.380768	19370.34961	-0.242922	20236.31836	2.301959	20	200	10/20/2016 17:34
28342-9.2 SPK	#2	0.196	398.906433	18899.68359	-0.889794	20236.31836	2.301959	20	200	10/20/2016 17:37
28342-10.2	#1	0.0015	5.415268	43.766075	-1.482636	20236.31836	2.301959	20	200	10/20/2016 17:39
28342-10.2	#2	0.0032	8.733123	401.573273	0.161348	20236.31836	2.301959	20	200	10/20/2016 17:41
28342-11.2	#1	0.0021	6.465786	264.907471	-0.190418	20236.31836	2.301959	20	200	10/20/2016 17:44
28342-11.2	#2	0.002	6.320538	291.09375	-0.155941	20236.31836	2.301959	20	200	10/20/2016 17:46
28342-11.2 TRP	#1	0.0031	8.607958	395.315094	-0.255876	20236.31836	2.301959	20	200	10/20/2016 17:48
28342-11.2 TRP	#2	0.0029	8.149884	369.098572	0.105677	20236.31836	2.301959	20	200	10/20/2016 17:50
28342-12.2	#1	0.0026	7.492364	343.124634	-0.251001	20236.31836	2.301959	20	200	10/20/2016 17:52

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## PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
28342-12.2	#2	0.0023	6.945828	298.193726	-0.186795	20236.31836	2.301959	20	200	10/20/2016 17:54
28342-12.2 SPK #1		0.1942	395.392273	18702.85352	-0.041857	20236.31836	2.301959	20	200	10/20/2016 17:57
28342-12.2 SPK #2		0.1964	399.740326	18793.55859	-0.801936	20236.31836	2.301959	20	200	10/20/2016 17:59
QC 2		0.0193	392.18158	18532.67969	-0.494642	20236.31836	2.301959	1	1	10/20/2016 18:04
QC 3		0.0203	412.381165	19544.375	-1.369518	20236.31836	2.301959	1	1	10/20/2016 18:07
Blk		0	1.693855	-306.945068	-1.693855	20236.31836	2.301959	1	1	10/20/2016 18:10
28342-14.2	#1	0.0002	2.683931	115.696938	0.044196	20236.31836	2.301959	20	200	10/20/2016 18:12
28342-14.2	#2	0	2.372793	89.463562	-0.139563	20236.31836	2.301959	20	200	10/20/2016 18:14
28342-1.3	#1	0.2447	249.895538	11715.41406	-0.322263	20236.31836	2.301959	10	200	10/20/2016 18:16
28342-1.3	#2	0.2427	247.876114	11506.51074	-0.945023	20236.31836	2.301959	10	200	10/20/2016 18:19
28342-2.3	#1	0.5231	214.018692	9791.047852	-1.795128	20236.31836	2.301959	10	500	10/20/2016 18:21
28342-2.3	#2	0.5192	212.423462	9646.496094	-1.957468	20236.31836	2.301959	10	500	10/20/2016 18:24
28342-2.3 TRP #1		0.604	206.016144	9406.662109	-1.887295	20236.31836	2.301959	10	600	10/20/2016 18:26
28342-2.3 TRP #2		0.6257	213.324646	9796.9375	-2.106666	20236.31836	2.301959	10	600	10/20/2016 18:28
28342-3.3	#1	0.7611	259.009735	11789.06836	-1.830216	20236.31836	2.301959	10	600	10/20/2016 18:31
28342-3.3	#2	0.768	261.334595	11719.19727	-2.100221	20236.31836	2.301959	10	600	10/20/2016 18:33
28342-3.3 SPK #1		1.9874	672.581787	31402.69336	-2.158208	20236.31836	2.301959	10	600	10/20/2016 18:35
28342-3.3 SPK #2		1.9835	671.26947	31086.07227	-2.30767	20236.31836	2.301959	10	600	10/20/2016 18:38
28342-4.3	#1	0.9464	321.502869	14550.81445	-2.626543	20236.31836	2.301959	10	600	10/20/2016 18:41
28342-4.3	#2	0.9185	312.097717	14377.00684	-2.602658	20236.31836	2.301959	10	600	10/20/2016 18:43
28342-5.3	#1	0.8946	304.025665	13884.95801	-2.527855	20236.31836	2.301959	10	600	10/20/2016 18:45
28342-5.3	#2	0.8907	302.715942	13835.17188	-2.651275	20236.31836	2.301959	10	600	10/20/2016 18:48
28342-5.3 TRP #1		0.8551	290.687683	13275.22754	-2.565743	20236.31836	2.301959	10	600	10/20/2016 18:50
28342-5.3 TRP #2		0.869	295.399841	12997.66699	-2.543648	20236.31836	2.301959	10	600	10/20/2016 18:52
28342-6.3	#1	0.8505	289.160004	12825.22852	-2.259982	20236.31836	2.301959	10	600	10/20/2016 18:55
28342-6.3	#2	0.8528	289.917694	13150.42578	-2.539636	20236.31836	2.301959	10	600	10/20/2016 18:57
QC 2		0.0212	430.475067	20292.24023	-0.424846	20236.31836	2.301959	1	1	10/20/2016 19:02
QC 3		0.0211	429.288757	20111.2832	-1.00195	20236.31836	2.301959	1	1	10/20/2016 19:04
Blk		0	1.67969	-316.427368	-1.67969	20236.31836	2.301959	1	1	10/20/2016 19:07
28342-6.3 SPK #1		2.1978	743.54541	34616.55469	0.106679	20236.31836	2.301959	10	600	10/20/2016 19:09
28342-6.3 SPK #2		2.1837	738.78717	34563.26563	-0.904705	20236.31836	2.301959	10	600	10/20/2016 19:12
28342-7.3	#1	1.384	402.41272	18574.88281	-1.512728	20236.31836	2.301959	10	700	10/20/2016 19:15
28342-7.3	#2	1.3968	406.116119	18686.4375	-1.782902	20236.31836	2.301959	10	700	10/20/2016 19:17
28342-8.3	#1	1.4056	408.641418	18606.40039	-2.301261	20236.31836	2.301959	10	700	10/20/2016 19:20
28342-8.3	#2	1.3828	402.065277	18305.55664	-2.243477	20236.31836	2.301959	10	700	10/20/2016 19:22
28342-8.3 TRP #1		1.4385	418.146362	19169.24805	-2.668243	20236.31836	2.301959	10	700	10/20/2016 19:25
28342-8.3 TRP #2		1.4038	408.112396	18994.30078	-2.340557	20236.31836	2.301959	10	700	10/20/2016 19:27
28342-9.3	#1	1.3076	380.3284	17613.9375	-2.563517	20236.31836	2.301959	10	700	10/20/2016 19:30
28342-9.3	#2	1.3147	382.382141	17664.6543	-2.488328	20236.31836	2.301959	10	700	10/20/2016 19:32
28342-9.3 SPK #1		2.7612	800.525879	37293.78906	-2.378954	20236.31836	2.301959	10	700	10/20/2016 19:35
28342-9.3 SPK #2		2.7762	804.866882	37206.03906	-2.401451	20236.31836	2.301959	10	700	10/20/2016 19:37
28342-10.3	#1	1.3802	401.311127	18463.9082	-1.826761	20236.31836	2.301959	10	700	10/20/2016 19:40
28342-10.3	#2	1.3728	399.160645	18469.18945	-2.362474	20236.31836	2.301959	10	700	10/20/2016 19:43
28342-11.3	#1	1.2268	356.95105	16337.27441	-2.188507	20236.31836	2.301959	10	700	10/20/2016 19:45
28342-11.3	#2	1.2094	351.941437	16145.07031	-2.747648	20236.31836	2.301959	10	700	10/20/2016 19:48
28342-11.3 TRP #1		1.2067	351.153931	16017.40332	-2.822621	20236.31836	2.301959	10	700	10/20/2016 19:50
28342-11.3 TRP #2		1.199	348.924164	15869.19043	-2.549157	20236.31836	2.301959	10	700	10/20/2016 19:52
28342-12.3	#1	1.345	391.130463	17935.64063	-2.49301	20236.31836	2.301959	10	700	10/20/2016 19:55
28342-12.3	#2	1.347	391.692688	17982.39063	-2.842776	20236.31836	2.301959	10	700	10/20/2016 19:57
QC 2		0.021	427.039398	20101.7832	-0.214184	20236.31836	2.301959	1	1	10/20/2016 20:02
QC 3		0.0217	441.690582	20860.45313	-1.229049	20236.31836	2.301959	1	1	10/20/2016 20:04

PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
BLK		0	1.671569	-287.433777	-1.671569	20236.31836	2.301959	1	1	10/20/2016 20:07
28342-13.3	#1	0.0015	2.915923	-101.524368	-1.572844	20236.31836	2.301959	10	500	10/20/2016 20:15
28342-13.3	#2	0.0066	4.978885	222.475189	0.240559	20236.31836	2.301959	10	500	10/20/2016 20:17
28342-14.3	#1	0.0211	10.841518	494.468231	0.277775	20236.31836	2.301959	10	500	10/20/2016 20:19
28342-14.3	#2	0.0206	10.620695	465.331848	-0.044241	20236.31836	2.301959	10	500	10/20/2016 20:22
28342-1.4	#1	0.0159	20.717316	1007.561462	-0.194871	20236.31836	2.301959	20	350	10/20/2016 20:24
28342-1.4	#2	0.0151	19.794744	911.56427	-0.241401	20236.31836	2.301959	20	350	10/20/2016 20:26
28342-3.4	#1	0.0126	22.654978	662.647156	-0.225947	20236.31836	2.301959	20	250	10/20/2016 20:37
28342-3.4	#2	0.0126	22.727251	692.771606	0.125327	20236.31836	2.301959	20	250	10/20/2016 20:39
28342-3.4 SPK	#1	0.2795	454.809204	13964.96582	-0.127418	20236.31836	2.301959	20	250	10/20/2016 20:41
28342-3.4 SPK	#2	0.275	447.481384	13589.61035	-1.165285	20236.31836	2.301959	20	250	10/20/2016 20:44
28342-4.4	#1	0.0145	25.807772	493.828522	-1.521525	20236.31836	2.301959	20	250	10/20/2016 20:46
28342-4.4	#2	0.0157	27.683815	819.899109	0.112061	20236.31836	2.301959	20	250	10/20/2016 20:49
DL		0.001	23.169132	671.157288	0.102359	20236.31836	2.301959	1	1	10/20/2016 20:55
QC 2		0.0199	405.657501	12331.53223	0.217192	20236.31836	2.301959	1	1	10/20/2016 20:57
QC 3		0.0207	421.926331	12703.96387	-1.336363	20236.31836	2.301959	1	1	10/20/2016 21:00
BLK		0	3.174551	-263.107178	-1.192029	20236.31836	2.301959	1	1	10/20/2016 21:03
28342-6.4	#1	0.0168	29.46413	892.181152	0.351138	20236.31836	2.301959	20	250	10/20/2016 21:09
28342-6.4	#2	0.0164	28.803186	873.501282	-0.304293	20236.31836	2.301959	20	250	10/20/2016 21:11
28342-6.4 SPK	#1	0.2717	442.188232	13718.56543	0.0511	20236.31836	2.301959	20	250	10/20/2016 21:14
28342-6.4 SPK	#2	0.2719	442.441864	13360.92481	-1.308085	20236.31836	2.301959	20	250	10/20/2016 21:16
28342-7.4	#1	0.0299	50.689838	1232.466064	-1.464503	20236.31836	2.301959	20	250	10/20/2016 21:19
28342-7.4	#2	0.0307	51.961094	1521.408081	0.187808	20236.31836	2.301959	20	250	10/20/2016 21:21
28342-9.4	#1	0.0361	60.709385	1853.761963	-0.561757	20236.31836	2.301959	20	250	10/20/2016 21:32
28342-9.4	#2	0.0351	59.118095	1741.150879	-0.317926	20236.31836	2.301959	20	250	10/20/2016 21:34
28342-9.4 SPK	#1	0.2933	477.124847	14566.87793	-0.107561	20236.31836	2.301959	20	250	10/20/2016 21:36
28342-9.4 SPK	#2	0.2901	471.953766	14354.02734	-0.909077	20236.31836	2.301959	20	250	10/20/2016 21:39
28342-10.4	#1	0.0409	68.46785	1721.046143	-1.842456	20236.31836	2.301959	20	250	10/20/2016 21:42
28342-10.4	#2	0.0425	71.133209	2085.30249	-0.534506	20236.31836	2.301959	20	250	10/20/2016 21:44
DL		0.001	23.289988	606.456848	-0.76536	20236.31836	2.301959	1	1	10/20/2016 21:50
QC 2		0.0201	409.358398	12469.3418	0.346847	20236.31836	2.301959	1	1	10/20/2016 21:52
QC 3		0.021	426.417419	12833.10742	-0.768104	20236.31836	2.301959	1	1	10/20/2016 21:55
BLK		0	1.987118	-304.61795	-1.494618	20236.31836	2.301959	1	1	10/20/2016 21:58
0		0	1.907707	80.839592	-0.025627	0	0	----	----	10/24/2016 13:28
0.001		0.001	19.475151	934.666321	-0.01522	17567.44336	1.907707	----	----	10/24/2016 13:30
0.002		0.002	35.064091	1640.067261	0.07011	16578.18945	2.237459	----	----	10/24/2016 13:32
0.004		0.004	68.734093	3231.881836	-0.389664	16625.46875	2.200688	----	----	10/24/2016 13:35
0.02		0.02	340.216583	15960.61621	-0.99624	16917.60156	1.724481	----	----	10/24/2016 13:37
0.04		0.04	681.229309	32153.87891	-1.344855	16981.04688	1.482786	----	----	10/24/2016 13:39
Blk		0	1.654148	-289.758392	-1.654148	16981.04688	1.482786	1	1	10/24/2016 13:42
DL		0.0011	19.550488	927.818604	-0.280095	16981.04688	1.482786	1	1	10/24/2016 13:44
QC 2		0.0202	344.98172	16373.42773	-0.370033	16981.04688	1.482786	1	1	10/24/2016 13:47
QC 3		0.0204	348.446228	16359.14551	-1.094124	16981.04688	1.482786	1	1	10/24/2016 13:49
Blk		0	1.716419	-308.866516	-1.716419	16981.04688	1.482786	1	1	10/24/2016 13:52
28342-6.3	#1	0.9123	259.670746	12163.7002	-0.019737	16981.04688	1.482786	10	600	10/24/2016 13:54
28342-6.3	#2	0.9021	256.799011	12173.28125	-0.938784	16981.04688	1.482786	10	600	10/24/2016 13:57
28342-6.3 SPK	#1	2.1363	606.083496	28689.01953	-1.686201	16981.04688	1.482786	10	600	10/24/2016 13:59
28342-6.3 SPK	#2	2.1599	612.762695	28949.58398	-1.895571	16981.04688	1.482786	10	600	10/24/2016 14:02
28342-12.3	#1	1.4084	343.14743	15749.85938	-2.091718	16981.04688	1.482786	10	700	10/24/2016 14:05
28342-12.3	#2	1.3831	336.994354	15650.18359	-2.17323	16981.04688	1.482786	10	700	10/24/2016 14:07
28342-12.3 SPK	#1	2.8902	702.60675	32562.51367	-2.420665	16981.04688	1.482786	10	700	10/24/2016 14:09

## PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
28342-12.3 SPK #2		2.9266	711.437378	33085.32813	-2.109996	16981.04688	1.482786	10	700	10/24/2016 14:12
28342-2.4 #2		0.0188	27.001842	1235.623657	-0.236225	16981.04688	1.482786	20	250	10/24/2016 14:17
28342-2.4 TRP #1		0.0181	26.069702	1179.487305	-0.525948	16981.04688	1.482786	20	250	10/24/2016 14:19
28342-2.4 TRP #2		0.0178	25.710028	1162.123535	-0.341268	16981.04688	1.482786	20	250	10/24/2016 14:21
28342-5.4 #1		0.0173	24.924492	1149.710571	-0.4141	16981.04688	1.482786	20	250	10/24/2016 14:23
28342-5.4 #2		0.017	24.588047	1141.501221	-0.093609	16981.04688	1.482786	20	250	10/24/2016 14:26
28342-5.4 TRP #1		0.0167	24.140739	1121.257935	-0.273025	16981.04688	1.482786	20	250	10/24/2016 14:28
28342-5.4 TRP #2		0.0174	25.104904	1148.441284	-0.623001	16981.04688	1.482786	20	250	10/24/2016 14:30
28342-8.4 #1		0.0282	39.768902	1839.874756	-0.449436	16981.04688	1.482786	20	250	10/24/2016 14:32
28342-8.4 #2		0.0273	38.563496	1729.078125	-0.571844	16981.04688	1.482786	20	250	10/24/2016 14:34
28342-8.4 trp #1		0.0273	38.534012	1727.432251	-0.293181	16981.04688	1.482786	20	250	10/24/2016 14:37
28342-8.4 trp #2		0.0279	39.370609	1789.281128	-0.519871	16981.04688	1.482786	20	250	10/24/2016 14:39
DL		0.0011	19.489523	797.510864	-0.522985	16981.04688	1.482786	1	1	10/24/2016 14:41
QC 3		0.0219	372.906586	17356.89258	-0.901712	16981.04688	1.482786	1	1	10/24/2016 14:46
Blk		0	1.256621	-298.63385	-1.256621	16981.04688	1.482786	1	1	10/24/2016 14:48
0		0	2.073398	84.471359	-0.170292	0	0	----	----	10/25/2016 11:30
0.001		0.001	21.484406	999.301941	0.039857	19411.00586	2.073399	----	----	10/25/2016 11:32
0.002		0.002	38.029541	1739.739746	-0.059861	17978.07031	2.551045	----	----	10/25/2016 11:34
0.004		0.004	72.510948	3298.237793	-0.478035	17476.0293	2.941523	----	----	10/25/2016 11:36
0.02		0.02	349.179596	16185.0166	-1.073885	17301.88477	3.225406	----	----	10/25/2016 11:38
0.04		0.04	710.577759	33434.14844	-1.565104	17647.95117	1.907147	----	----	10/25/2016 11:41
Blk		0	1.249308	-350.165894	-1.249308	17647.95117	1.907147	1	1	10/25/2016 11:44
DL		0.0011	21.309303	943.500427	-0.107811	17647.95117	1.907147	1	1	10/25/2016 11:46
QC 2		0.0198	351.172089	16129.68945	-0.293956	17647.95117	1.907147	1	1	10/25/2016 11:48
QC 3		0.0195	346.065247	15811.64063	-0.892706	17647.95117	1.907147	1	1	10/25/2016 11:51
Blk		0	1.316903	-281.867035	-1.316903	17647.95117	1.907147	1	1	10/25/2016 11:54
28342-13.5 #1		0.0247	19.348188	830.44635	-0.039869	17647.95117	1.907147	20	500	10/25/2016 11:56
28342-13.5 #2		0.0231	18.207634	764.559937	-0.026024	17647.95117	1.907147	20	500	10/25/2016 11:58
28342-14.5 #1		0.0065	6.508363	273.720154	-0.579339	17647.95117	1.907147	20	500	10/25/2016 12:00
28342-14.5 #2		0.0067	6.667707	284.621918	-0.154303	17647.95117	1.907147	20	500	10/25/2016 12:02
28342-14.6 #1		0.3691	262.478851	11718.33106	-0.169538	17647.95117	1.907147	20	500	10/25/2016 12:04
28342-14.6 #2		0.3833	272.473053	11979.72168	-0.871795	17647.95117	1.907147	20	500	10/25/2016 12:07
28342-11.4 #1		0.0401	58.570362	2443.733643	-1.567974	17647.95117	1.907147	20	250	10/25/2016 12:10
28342-11.4 #2		0.0385	56.209538	2364.159668	-0.329937	17647.95117	1.907147	20	250	10/25/2016 12:12
28342-11.4 TRP #1		0.0376	54.990051	2311.819824	-0.921297	17647.95117	1.907147	20	250	10/25/2016 12:14
28342-11.4 TRP #2		0.0386	56.333107	2391.44165	-0.663103	17647.95117	1.907147	20	250	10/25/2016 12:16
28342-12.4 #1		0.0315	46.413765	1905.569336	-0.672197	17647.95117	1.907147	20	250	10/25/2016 12:18
28342-12.4 #2		0.0341	50.119812	2116.403809	-0.598665	17647.95117	1.907147	20	250	10/25/2016 12:21
28342-12.4 SPK #1		0.3193	452.686127	20264.04492	-0.34407	17647.95117	1.907147	20	250	10/25/2016 12:23
28342-12.4 SPK #2		0.3198	453.452118	20162.46484	-1.680932	17647.95117	1.907147	20	250	10/25/2016 12:26
28342-13.4 #1		0.0027	5.770021	-25.642326	-1.943308	17647.95117	1.907147	20	250	10/25/2016 12:28
28342-13.4 #2		0.0052	9.250304	386.475677	-0.066978	17647.95117	1.907147	20	250	10/25/2016 12:30
28342-14.4 #1		0.0326	47.87146	2104.370605	0.329254	17647.95117	1.907147	20	250	10/25/2016 12:33
28342-14.4 #2		0.032	47.122044	1999.832886	-0.713009	17647.95117	1.907147	20	250	10/25/2016 12:35
28342-1.5 #1		3.4435	488.047302	21921.40625	-0.600284	17647.95117	1.907147	4	500	10/25/2016 12:37
28342-1.5 #2		3.5655	505.294098	22968.20117	-1.663777	17647.95117	1.907147	4	500	10/25/2016 12:40
QC 2		0.0198	352.211884	15904.62988	-0.442704	17647.95117	1.907147	1	1	10/25/2016 12:45
QC 3		0.0196	348.027924	15555.69824	-0.844937	17647.95117	1.907147	1	1	10/25/2016 12:47
Blk		0	1.518891	-323.399872	-1.508866	17647.95117	1.907147	1	1	10/25/2016 12:50
28342-2.5 #1		3.7965	448.5755	20646.02344	-0.562946	17647.95117	1.907147	4	600	10/25/2016 12:52
28342-2.5 #2		3.573	422.275024	18682.61328	-0.8656	17647.95117	1.907147	4	600	10/25/2016 12:55

elementOne

## PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
28342-2.5 trp	#1	3.5745	422.430054	18697.23633	-1.545392	17647.95117	1.907147	4	600	10/25/2016 12:58
28342-2.5 trp	#2	3.4685	410.002411	18216.84375	-2.046849	17647.95117	1.907147	4	600	10/25/2016 13:00
28342-3.5	#1	3.844	454.139221	20433.53711	-2.027125	17647.95117	1.907147	4	600	10/25/2016 13:03
28342-3.5	#2	3.85	454.887726	20314.2207	-2.377237	17647.95117	1.907147	4	600	10/25/2016 13:05
28342-3.5 spk	#1	6.8185	804.11377	35559.57813	-2.031981	17647.95117	1.907147	4	600	10/25/2016 13:08
28342-3.5 spk	#2	6.67	786.63678	34932.53906	-2.190122	17647.95117	1.907147	4	600	10/25/2016 13:11
28342-4.5	#1	5.5555	562.162109	25129.16992	-2.349247	17647.95117	1.907147	4	700	10/25/2016 13:14
28342-4.5	#2	5.5525	561.857849	24963.66992	-2.331194	17647.95117	1.907147	4	700	10/25/2016 13:16
28342-5.5	#1	5.502	556.780884	25005.98047	-2.168382	17647.95117	1.907147	4	700	10/25/2016 13:19
28342-5.5	#2	5.275	533.875977	23698.6875	-2.313029	17647.95117	1.907147	4	700	10/25/2016 13:22
28342-5.5 trp	#1	5.751	581.851135	26798.24219	-2.543159	17647.95117	1.907147	4	700	10/25/2016 13:24
28342-5.5 trp	#2	5.8015	586.962891	27042.6875	-2.668257	17647.95117	1.907147	4	700	10/25/2016 13:27
DL		0.001	20.027605	775.092651	-0.610926	17647.95117	1.907147	1	1	10/25/2016 13:45
QC 2		0.0198	350.594727	15978.86914	0.020008	17647.95117	1.907147	1	1	10/25/2016 13:47
QC 3		0.0192	339.979431	14972.02246	-1.151303	17647.95117	1.907147	1	1	10/25/2016 13:49
Blk		0	1.603518	-321.321014	-1.603518	17647.95117	1.907147	1	1	10/25/2016 13:52
0.001		0.001	20.646811	993.221191	-0.037069	18185.12891	2.461681	----	----	10/26/2016 10:41
0.002		0.002	37.983353	1751.22583	-0.075043	17760.83398	2.603112	----	----	10/26/2016 10:44
0.004		0.004	72.395302	3394.268311	-0.500314	17439.10938	2.853348	----	----	10/26/2016 10:46
0.02		0.02	347.576965	16505.37305	-1.069346	17223.79297	3.204345	----	----	10/26/2016 10:48
0.04		0.04	710.794434	33692.55469	-1.788598	17646.00781	1.596006	----	----	10/26/2016 10:51
Blk		0	1.484575	-297.168335	-1.484575	17646.00781	1.596006	1	1	10/26/2016 10:53
DL		0.0011	20.691429	983.850586	-0.307801	17646.00781	1.596006	1	1	10/26/2016 10:56
QC 2		0.0204	361.303711	17062.4043	-0.567087	17646.00781	1.596006	1	1	10/26/2016 10:58
QC 3		0.0201	356.447723	16900.58203	-0.926127	17646.00781	1.596006	1	1	10/26/2016 11:00
Blk		0	1.6898	-290.393799	-1.6898	17646.00781	1.596006	1	1	10/26/2016 11:03
28342-12.4	#1	0.0326	47.577858	2432.237549	0.066275	17646.00781	1.596006	20	250	10/26/2016 11:05
28342-12.4	#2	0.0297	43.57008	2062.861572	-0.997492	17646.00781	1.596006	20	250	10/26/2016 11:07
28342-12.4 SPK #1		0.2607	369.585205	17928.81055	-0.675219	17646.00781	1.596006	20	250	10/26/2016 11:10
28342-12.4 SPK #2		0.2625	372.225006	17817.13867	-1.227205	17646.00781	1.596006	20	250	10/26/2016 11:12
28342-6.5	#1	6.1778	364.974548	17373.32227	-1.653517	17646.00781	1.596006	2	600	10/26/2016 11:15
28342-6.5	#2	6.2682	370.289307	17546.34961	-2.061538	17646.00781	1.596006	2	600	10/26/2016 11:17
28342-6.5 spk	#1	12.0709	711.607605	34041.50781	-2.218906	17646.00781	1.596006	2	600	10/26/2016 11:20
28342-6.5 spk	#2	12.0714	711.635071	33837.66406	-2.132087	17646.00781	1.596006	2	600	10/26/2016 11:23
28342-8.5	#1	11.7341	297.397125	13918.47363	-2.190868	17646.00781	1.596006	1	700	10/26/2016 11:25
28342-8.5	#2	11.7857	298.697906	14013.91699	-2.471215	17646.00781	1.596006	1	700	10/26/2016 11:28
28342-8.5 trp	#1	11.7066	296.701935	13605.67676	-2.20502	17646.00781	1.596006	1	700	10/26/2016 11:30
28342-8.5 trp	#2	11.8033	299.13974	13888.21777	-2.639756	17646.00781	1.596006	1	700	10/26/2016 11:33
28342-9.5	#1	11.0092	279.123016	12961.74219	-2.685277	17646.00781	1.596006	1	700	10/26/2016 11:35
28342-9.5	#2	11.1078	281.607605	13040.94922	-2.616377	17646.00781	1.596006	1	700	10/26/2016 11:37
28342-9.5 spk	#1	26.295	664.455688	31563.95508	-2.644268	17646.00781	1.596006	1	700	10/26/2016 11:40
28342-9.5 spk	#2	25.6773	648.88385	30576.93555	-2.719289	17646.00781	1.596006	1	700	10/26/2016 11:42
28342-10.5	#1	14.516	367.523651	17193.91992	-2.445925	17646.00781	1.596006	1	700	10/26/2016 11:45
28342-10.5	#2	14.6205	370.158844	17269.16016	-2.682869	17646.00781	1.596006	1	700	10/26/2016 11:47
28342-11.5	#1	10.5955	268.69458	12457.82715	-2.291236	17646.00781	1.596006	1	700	10/26/2016 11:50
QC 2		0.0206	365.481293	17156.78906	-0.337133	17646.00781	1.596006	1	1	10/26/2016 11:57
QC 3		0.0204	361.369476	17145.8418	-1.240362	17646.00781	1.596006	1	1	10/26/2016 12:00
28342-11.5 TRP #1		10.7122	271.635315	12966.61914	-0.016727	17646.00781	1.596006	1	700	10/26/2016 12:04
28342-11.5 TRP #2		10.86	275.360779	13009.49707	-1.24123	17646.00781	1.596006	1	700	10/26/2016 12:07
28342-7.5	#1	10.9828	647.606812	30387.58398	-1.963517	17646.00781	1.596006	2	600	10/26/2016 12:20
28342-7.5	#2	11.349	669.143555	31783.53516	-2.465445	17646.00781	1.596006	2	600	10/26/2016 12:23

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## PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
DL		0.0009	18.332054	501.89444	-2.491035	17646.00781	1.596006	1	1	10/26/2016 12:26
QC 2		0.0208	367.748138	17096.91211	-0.269615	17646.00781	1.596006	1	1	10/26/2016 12:28
QC 3		0.0201	355.46524	16314.93359	-1.49196	17646.00781	1.596006	1	1	10/26/2016 12:31
Blk		0	1.606828	-321.532684	-1.606828	17646.00781	1.596006	1	1	10/26/2016 12:33
0		0	4.612566	188.704468	0.146147	0	0	----	----	10/28/2016 12:26
0.001		0.001	26.835075	1268.384521	-0.067269	22222.50781	4.612566	----	----	10/28/2016 12:29
0.002		0.002	45.77309	2100.456543	-0.446972	20580.25977	5.159985	----	----	10/28/2016 12:31
0.004		0.004	86.052811	3930.244873	-0.164222	20213.00391	5.445628	----	----	10/28/2016 12:33
0.02		0.02	412.289825	19408.07227	-0.701995	20350.09766	5.222147	----	----	10/28/2016 12:35
0.04		0.04	834.435059	38787.60156	-1.981692	20694.62695	3.909734	----	----	10/28/2016 12:38
Blk		0	1.614556	-190.940857	-1.614556	20694.62695	3.909734	1	1	10/28/2016 12:40
DL		0.0011	27.273794	1244.262695	0.088892	20694.62695	3.909734	1	1	10/28/2016 12:42
QC 2		0.0196	409.835388	18979.78125	-0.157183	20694.62695	3.909734	1	1	10/28/2016 12:45
QC 3		0.0198	413.521942	19002.51758	-1.472677	20694.62695	3.909734	1	1	10/28/2016 12:47
Blk		0	1.423103	-194.674896	-1.391525	20694.62695	3.909734	1	1	10/28/2016 12:50
28342-12.5	#1	16.4781	491.063477	22676.84375	0.206602	20694.62695	3.909734	1	700	10/28/2016 12:52
28342-12.5	#2	16.8378	501.698334	23245.09766	-0.948672	20694.62695	3.909734	1	700	10/28/2016 12:55
28342-12.5 SPK #1		30.0699	892.88739	41677.01172	-1.198322	20694.62695	3.909734	1	700	10/28/2016 12:57
28342-12.5 SPK #2		30.2445	898.050415	41449.89063	-1.766981	20694.62695	3.909734	1	700	10/28/2016 13:00
283423-LRB FIL #1		0.0161	70.671265	2956.169922	-1.741852	20694.62695	3.909734	10	50	10/28/2016 13:03
283423-LRB FIL #2		0.0147	64.829971	2856.912354	-0.585834	20694.62695	3.909734	10	50	10/28/2016 13:05
28342-LRB FIL #1		2.8279	472.093323	21985.88867	-0.70487	20694.62695	3.909734	0.4	50	10/28/2016 13:07
28342-LRB FIL #2		2.9359	489.962952	22963.51953	-1.253214	20694.62695	3.909734	0.4	50	10/28/2016 13:10
28342-1.1	#1	0.0103	46.666225	1869.603027	-1.645985	20694.62695	3.909734	10	50	10/28/2016 13:13
28342-1.1	#2	0.0094	42.900368	1823.470703	0.07152	20694.62695	3.909734	10	50	10/28/2016 13:15
28342-2.1	#1	0.0085	39.168114	1685.577271	0.219199	20694.62695	3.909734	10	50	10/28/2016 13:17
28342-2.1	#2	0.0083	38.262409	1616.61084	-0.481174	20694.62695	3.909734	10	50	10/28/2016 13:19
28342-2.1 TRP #1		0.0083	38.253143	1716.076782	0.006392	20694.62695	3.909734	10	50	10/28/2016 13:21
28342-2.1 TRP #2		0.008	37.193291	1604.71875	-0.533532	20694.62695	3.909734	10	50	10/28/2016 13:23
28342-3.1	#1	0.01	45.239216	1853.808716	-0.25485	20694.62695	3.909734	10	50	10/28/2016 13:26
28342-3.1	#2	0.0103	46.361111	1863.544189	-0.158366	20694.62695	3.909734	10	50	10/28/2016 13:28
28342-3.1 SPK #1		0.0753	315.73175	13133.00488	0.109213	20694.62695	3.909734	10	50	10/28/2016 13:30
28342-3.1 SPK #2		0.0735	307.991821	12784.87988	-0.140446	20694.62695	3.909734	10	50	10/28/2016 13:32
28342-4.1	#1	0.0113	50.513424	1999.391724	-0.344479	20694.62695	3.909734	10	50	10/28/2016 13:34
28342-4.1	#2	0.012	53.752655	2214.650635	0.077454	20694.62695	3.909734	10	50	10/28/2016 13:37
Blk		0	1.569789	-210.960648	-1.569789	20694.62695	3.909734	1	1	10/28/2016 13:46
28342-5.1	#1	0.0155	68.018127	2842.521484	0.130421	20694.62695	3.909734	10	50	10/28/2016 13:48
28342-5.1	#2	0.0128	56.965195	2356.324707	0.025612	20694.62695	3.909734	10	50	10/28/2016 13:50
28342-5.1 TRP #1		0.0128	57.019455	2324.793213	-0.117591	20694.62695	3.909734	10	50	10/28/2016 13:52
28342-5.1 TRP #2		0.0131	58.068367	2402.402344	-0.356202	20694.62695	3.909734	10	50	10/28/2016 13:55
28342-6.1	#1	0.0133	59.132927	2474.182373	0.05767	20694.62695	3.909734	10	50	10/28/2016 13:57
28342-6.1	#2	0.0133	58.997223	2441.253418	-0.444109	20694.62695	3.909734	10	50	10/28/2016 13:59
28342-6.1 SPK #1		0.0826	345.943604	14551.83984	-0.500614	20694.62695	3.909734	10	50	10/28/2016 14:01
28342-6.1 SPK #2		0.0802	335.652313	13994.31445	-0.851346	20694.62695	3.909734	10	50	10/28/2016 14:03
28342-7.1	#1	0.0155	67.9552	2600.276611	-1.005698	20694.62695	3.909734	10	50	10/28/2016 14:06
28342-7.1	#2	0.0165	72.041382	3016.509521	-0.228877	20694.62695	3.909734	10	50	10/28/2016 14:08
28342-8.1	#1	0.0117	52.206627	2066.677979	0.434699	20694.62695	3.909734	10	50	10/28/2016 14:10
28342-8.1	#2	0.0117	52.484528	2115.38208	0.405706	20694.62695	3.909734	10	50	10/28/2016 14:12
28342-8.1 TRP #1		0.0118	52.845287	2182.875488	-0.012327	20694.62695	3.909734	10	50	10/28/2016 14:14
28342-8.1 TRP #2		0.0113	50.630653	2115.434082	0.286706	20694.62695	3.909734	10	50	10/28/2016 14:16
28342-9.1	#1	0.0056	27.015862	1076.740479	0.127906	20694.62695	3.909734	10	50	10/28/2016 14:19

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## PS Analytical Millennium Galahad CVAF Analyzer

Sample ID	Inj	Conc	Pk Ht	Pk Area	Baseline	Slope	Intercept	Alq	Vol	Date/Time
28342-9.1	#2	0.0055	26.724243	1052.070801	0.168457	20694.62695	3.909734	10	50	10/28/2016 14:21
28342-9.1 SPK	#1	0.0708	297.111816	12349.50098	0.374894	20694.62695	3.909734	10	50	10/28/2016 14:23
28342-9.1 SPK	#2	0.0684	286.843384	11644.00879	-0.124962	20694.62695	3.909734	10	50	10/28/2016 14:25
28342-10.1	#1	0.0041	20.884047	698.83606	0.043039	20694.62695	3.909734	10	50	10/28/2016 14:27
28342-10.1	#2	0.0049	24.123962	1033.334595	-0.053566	20694.62695	3.909734	10	50	10/28/2016 14:30
28342-11.1	#1	0.0071	33.228302	1384.044556	-0.034906	20694.62695	3.909734	10	50	10/28/2016 14:41
28342-11.1	#2	0.0056	27.288586	1124.087158	-0.126805	20694.62695	3.909734	10	50	10/28/2016 14:43
28342-11.1 TRP	#1	0.0054	26.206434	1050.86438	-0.020658	20694.62695	3.909734	10	50	10/28/2016 14:45
28342-11.1 TRP	#2	0.0053	25.762209	1080.115967	-0.192049	20694.62695	3.909734	10	50	10/28/2016 14:47
28342-12.1	#1	0.0072	33.568165	1423.780884	-0.124059	20694.62695	3.909734	10	50	10/28/2016 14:50
28342-12.1	#2	0.0067	31.792459	1299.206299	-0.157717	20694.62695	3.909734	10	50	10/28/2016 14:52
278342-12.1 SP1	#1	0.0712	298.696198	12422.63965	0.126739	20694.62695	3.909734	10	50	10/28/2016 14:54
278342-12.1 SP1	#2	0.0711	298.130402	12323.87207	0.309592	20694.62695	3.909734	10	50	10/28/2016 14:56
28342-14.1	#1	0.0026	14.794341	436.619751	-0.767615	20694.62695	3.909734	10	50	10/28/2016 14:58
28342-14.1	#2	0.0042	21.337742	917.200562	-0.270046	20694.62695	3.909734	10	50	10/28/2016 15:01
DL		0.0009	23.18354	962.780579	0.044411	20694.62695	3.909734	1	1	10/28/2016 15:03
QC 3		0.0182	379.514618	16036.34766	-1.142759	20694.62695	3.909734	1	1	10/28/2016 15:07
Blk		0	1.851807	-358.303253	-1.851807	20694.62695	3.909734	1	1	10/28/2016 15:10
0		0	4.843215	214.252502	0.035402	0	0 ----	----		10/31/2016 14:02
0.001		0.001	21.061916	989.665955	-0.209476	16218.69922	4.843216 ----	----		10/31/2016 14:04
0.002		0.002	29.538574	1359.434082	-0.099334	12347.67773	6.133557 ----	----		10/31/2016 14:06
0.004		0.004	51.118599	2443.083984	-0.065849	11214.79199	7.014689 ----	----		10/31/2016 14:08
0.02		0.02	251.991989	11423.6543	-0.636463	12311.99121	5.226106 ----	----		10/31/2016 14:11
0.04		0.04	505.303711	22649.55664	-1.58082	12484.10742	4.570472 ----	----		10/31/2016 14:13
Blk		0	3.062371	-90.212456	-2.119935	12484.10742	4.570472	1	1	10/31/2016 14:15
DL		0.0014	22.159475	985.368652	0.186289	12484.10742	4.570472	1	1	10/31/2016 14:18
QC 2		0.0203	257.867371	11468.04004	-0.316781	12484.10742	4.570472	1	1	10/31/2016 14:20
QC 3		0.0181	230.554367	10545.73438	-0.22307	12484.10742	4.570472	1	1	10/31/2016 16:12
Blk		0	3.529847	-26.787699	0.291877	12484.10742	4.570472	1	1	10/31/2016 16:18
28342-3.1	#1	0.0114	18.827717	739.274353	-0.31538	12484.10742	4.570472	5	50	10/31/2016 16:21
28342-3.1	#2	0.0113	18.64669	755.801514	3.148453	12484.10742	4.570472	5	50	10/31/2016 16:23
28342-3.1 SPK	#1	0.179	227.99353	9962.529297	5.047296	12484.10742	4.570472	5	50	10/31/2016 16:25
28342-3.1 SPK	#2	0.1735	221.112122	9179.098633	5.987858	12484.10742	4.570472	5	50	10/31/2016 16:27
28342-6.1	#1	0.0021	7.18479	-120.293518	1.704187	12484.10742	4.570472	5	50	10/31/2016 16:29
28342-6.1	#2	0.0048	10.609884	430.010956	1.834605	12484.10742	4.570472	5	50	10/31/2016 16:31
28342-6.1 spk	#1	0.199	252.977493	11097.21582	1.21774	12484.10742	4.570472	5	50	10/31/2016 16:34
28342-6.1 spk	#2	0.2048	260.291016	11294.27148	-1.179316	12484.10742	4.570472	5	50	10/31/2016 16:36
28342-9.1	#1	0.0084	15.120015	268.193817	-0.707524	12484.10742	4.570472	5	50	10/31/2016 16:39
28342-9.1	#2	0.0101	17.180454	660.686523	1.434247	12484.10742	4.570472	5	50	10/31/2016 16:41
28342-9.1 SPK	#1	0.2028	257.792938	10981.8916	1.319575	12484.10742	4.570472	5	50	10/31/2016 16:43
28342-9.1 SPK	#2	0.1949	247.8396	10470.48731	-0.75209	12484.10742	4.570472	5	50	10/31/2016 16:45
28342-12.1	#1	0.0044	10.03846	-20.7099	-1.449562	12484.10742	4.570472	5	50	10/31/2016 16:47
28342-12.1	#2	0.0097	16.714437	566.55188	0.391466	12484.10742	4.570472	5	50	10/31/2016 16:50
28342-12.1 spk	#1	0.1998	254.043961	11383.06641	0.134843	12484.10742	4.570472	5	50	10/31/2016 16:52
28342-12.1 spk	#2	0.2037	258.887085	11247.46191	-1.438468	12484.10742	4.570472	5	50	10/31/2016 16:54
DL		0.0005	11.159133	72.333809	-1.154616	12484.10742	4.570472	1	1	10/31/2016 16:57
QC 2		0.0198	251.472626	10733.9082	-0.428846	12484.10742	4.570472	1	1	10/31/2016 16:59
QC 3		0.0195	248.101196	10390.8291	-0.437623	12484.10742	4.570472	1	1	10/31/2016 17:01
Blk		0	1.907505	-415.233734	-1.876316	12484.10742	4.570472	1	1	10/31/2016 17:04

## Appendix D

### Calibration Data



# Routine Dry Gas Meter Calibration

Control Module: C-8 Leak checks Barometric Press. -- 29.08  
Date: 09/09/16 Negative Pass >5 W.C. Previous Y -- 0.9883  
Technician: RMP Positive - Pass > in.Hg Previous Delta H -- 1.9107

Orifice Diff Pressure H	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 0.500	Initial 1387.00	Initial 81.0	Initial 75.0	Initial 73.5	Initial 148.190			0.9782	1.9075
Actual	Final 1398.00	Final 78.0	Final 75.0	Final 73.5	Final 159.500	Minutes 28	SEC 12.78		
0.50	Total 11.00	Average 79.5	Average 75.0	Average 73.5	Total 11.310	28.21			
		77.3							
Nominal 1.000	Initial 1357.00	Initial 86.0	Initial 77.0	Initial 73.5	Initial 117.360			0.9817	1.9019
Actual	Final 1386.00	Final 81.0	Final 75.0	Final 73.5	Final 147.170	Minutes 52.0	SEC 34		
1.00	Total 29.00	Average 83.5	Average 76.0	Average 73.5	Total 29.810	52.57			
		79.8 Tm							
Nominal 2.000	Initial 1321.00	Initial 81.0	Initial 74.0	Initial 72.0	Initial 80.400			0.9831	1.9205
Actual	Final 1329.00	Final 82.0	Final 74.0	Final 72.5	Final 88.580	Minutes 10	SEC 18.53		
2.00	Total 8.00	Average 81.5	Average 74.0	Average 72.3	Total 8.180	10.31			
		77.8 Tm							
Nominal 3.000	Initial 1330.00	Initial 83.0	Initial 74.0	Initial 72.5	Initial 89.610			0.9795	1.9418
Actual	Final 1339.00	Final 85.0	Final 75.0	Final 73.0	Final 98.840	Minutes 9.0	SEC 31.03		
3.00	Total 9.00	Average 84.0	Average 74.5	Average 72.8	Total 9.230	9.52			
		79.3 Tm							
Nominal 4.000	Initial 1340.00	Initial 85.0	Initial 75.0	Initial 73.0	Initial 99.870			0.9770	1.9562
Actual	Final 1355.00	Final 88.0	Final 76.0	Final 73.5	Final 115.290	Minutes 13.0	SEC 47.25		
4.00	Total 15.00	Average 86.5	Average 75.5	Average 73.3	Total 15.420	13.79			
		81.0 Tm		Average				0.9799	1.9256

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Pellet Indurating Furnace Line 2 - Stack 4 (SV025)  
Control Module C-8

TEST 4 - Baseline

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	10/4/2016	10/4/2016	10/5/2016
Test period	-	-	1023 - 1228	1256 - 1503	745 - 950
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	87.4	87.5	86.6
Absolute average dry gas meter temp	T <sub>m</sub>	°F	67.6	70.3	60.6
Absolute average dry gas meter temp	T <sub>m</sub>	°R	527.3	530.0	520.3
Barometric pressure	P <sub>b</sub>	inches Hg	28.2	28.2	27.9
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	1.68	1.68	1.65
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	1.93	1.93	1.93
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	28.89	28.89	28.89
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	0.9904	0.9919	0.9893
Dry gas meter calibration factor	Y	Dimensionless	0.9799	0.9799	0.9799
Average of Y <sub>qa</sub> 's from test run series	<b>0.9905</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \frac{29}{M_d}} \cdot (\sqrt{\Delta h_{avg}})$			
Dry gas meter calibration factor	<b>0.9799</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-1.09%</b>				
(must be within ± 5%)					

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Pellet Indurating Furnace Line 2 - Stack 3 (SV026)  
Control Module C-8

Test 3 - Baseline

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	10/3/2016	10/3/2016	10/4/2016
Test period	-	-	1035 - 1415	1505 - 1712	746 - 953
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	87.9	89.8	87.7
Absolute average dry gas meter temp	T <sub>m</sub>	°F	72.4	85.2	56.3
Absolute average dry gas meter temp	T <sub>m</sub>	°R	532.1	544.8	516.0
Barometric pressure	P <sub>b</sub>	inches Hg	28.3	28.3	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	1.69	1.73	1.72
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	1.93	1.93	1.93
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	28.88	28.88	28.88
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	0.9903	0.9933	0.9891
Dry gas meter calibration factor	Y	Dimensionless	0.9799	0.9799	0.9799
Average of Y <sub>qa</sub> 's from test run series	<b>0.9909</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \cdot \frac{29}{M_d}} \cdot (\sqrt{\Delta h_{avg}})$			
Dry gas meter calibration factor	<b>0.9799</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-1.12%</b>				
(must be within ± 5%)					



## PYROMETER CALIBRATION

Pyrometer Number: C8      Date: 1/18/2016  
Pyrometer Reference: CL-3512-A      Technician: RMP

Reference (°F)	Reference (°C)	Pyrometer ° F	
		Reading	Pass/Fail
1000	538	1003	Pass
950	510	953	Pass
900	482	902	Pass
850	454	852	Pass
800	427	802	Pass
750	399	752	Pass
700	371	702	Pass
650	343	652	Pass
600	316	599	Pass
550	288	548	Pass
500	260	497	Pass
450	232	446	Pass
400	204	397	Pass
350	177	347	Pass
300	149	298	Pass
250	121	248	Pass
200	93	197	Pass
150	67	149	Pass
100	38	97	Pass
50	10	47	Pass
0	-18	-2	Pass
-50	-46	-54	Fail

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

**Unit not to be used at range in which failure occurred**

Technician signature:

QA signature:




## THERMOCOUPLE CALIBRATION

Meter In THERMOCOUPLE ID C8-I  
Cal Date: 1/15/2016

CALIBRATION TECHNICIAN: RMP

REFERENCE STANDARDS	TRACEABILITY		DATE	LABORATORY
Hart Scientific 9103-A s/n A1B289	Report No. T15-1116-JC-2		11/16/2015	NBS Calibrations
Hart Scientific 9140 s/n A1B086	Report No. T15-1116-JC-1		11/16/2015	NBS Calibrations
Temperature Calibration Points	20	70	150	
Reference Deg F (To)	20	70	150	
Probe Temp (deg F)	22.0	70.0	148.0	
Difference (degrees)	2.0	0.0	2.0	
TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)				
	YES	YES	YES	

Technician signature 

QA signature 



## THERMOCOUPLE CALIBRATION

Meter Out

THERMOCOUPLE ID C8-O

Cal Date: 1/15/2016

CALIBRATION TECHNICIAN: RMP

### REFERENCE STANDARDS

### TRACEABILITY

### DATE

### LABORATORY

Hart Scientific 9103-A s/n A1B289

Report No. T15-1116-JC-2

11/16/2015

NBS Calibrations

Hart Scientific 9140 s/n A1B086

Report No. T15-1116-JC-1

11/16/2015

NBS Calibrations

### Temperature Calibration Points

20

70

150

Reference Deg F (To)

20

70

150

Probe Temp (deg F)

22.0

69.0

148.0

Difference (degrees)

2.0

1.0


2.0

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

YES

YES

YES

Technician signature 

QA signature 





# Routine Dry Gas Meter Calibration

Control Module: C-5 Leak checks Barometric Press. -- 29.17  
Date: 08/10/16 Negative Pass >5 W.C. Previous Y -- 0.9996  
Technician: DAH Positive - Pass > in.Hg Previous Delta H -- 1.9448

Orifice Diff Pressure H	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 0.500	Initial 716.00	Initial 77.0	Initial 73.0	Initial 73.0	Initial 933.440			1.0183	1.8036
Actual  0.50	Final 721.00	Final 76.0	Final 73.0	Final 73.0	Final 938.360	Minutes 12	SEC 28.66		
	Total 5.00	Average 76.5	Average 73.0	Average 73.0	Total 4.920	Minutes 12.48			
		74.8							
Nominal 1.000	Initial 710.00	Initial 81.0	Initial 72.0	Initial 73.0	Initial 927.540			1.0173	1.8598
Actual  1.00	Final 715.00	Final 78.0	Final 73.0	Final 73.0	Final 932.470	Minutes 8.0	SEC 57.31		
	Total 5.00	Average 79.5	Average 72.5	Average 73.0	Total 4.930	8.96			
		76.0 Tm							
Nominal 2.000	Initial 684.00	Initial 72.0	Initial 69.0	Initial 73.0	Initial 901.840			1.0078	1.9128
Actual  2.00	Final 689.00	Final 74.0	Final 70.0	Final 73.0	Final 906.760	Minutes 6	SEC 24.22		
	Total 5.00	Average 73.0	Average 69.5	Average 73.0	Total 4.920	6.40			
		71.3 Tm							
Nominal 3.000	Initial 690.00	Initial 75.0	Initial 70.0	Initial 73.0	Initial 907.750			1.0020	1.9216
Actual  3.00	Final 695.00	Final 76.0	Final 70.0	Final 73.0	Final 912.700	Minutes 5.0	SEC 14.59		
	Total 5.00	Average 75.5	Average 70.0	Average 73.0	Total 4.950	5.24			
		72.8 Tm							
Nominal 4.000	Initial 696.00	Initial 77.0	Initial 71.0	Initial 73.0	Initial 913.690			1.0042	1.9146
Actual  4.00	Final 709.00	Final 81.0	Final 72.0	Final 73.0	Final 926.560	Minutes 11.0	SEC 48.06		
	Total 13.00	Average 79.0	Average 71.5	Average 73.0	Total 12.870	11.80			
		75.3 Tm		Average					

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Pellet Indurating Furnace Line 2 - Stack 2 (SV027)  
Control Module C-5

Test 2 - Baseline

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	10/4/2016	10/4/2016	10/5/2016
Test period	-	-	1023 - 1228	1256 - 1503	745 - 950
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	88.4	90.3	87.4
Absolute average dry gas meter temp	T <sub>m</sub>	°F	65.9	69.2	59.4
Absolute average dry gas meter temp	T <sub>m</sub>	°R	525.6	528.9	519.1
Barometric pressure	P <sub>b</sub>	inches Hg	28.2	28.2	27.9
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	1.78	1.85	1.75
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	1.88	1.88	1.88
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	28.86	28.86	28.86
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	1.0196	1.0185	1.0198
Dry gas meter calibration factor	Y	Dimensionless	1.0100	1.0100	1.0100
Average of Y <sub>qa</sub> 's from test run series	<b>1.0193</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \frac{29}{M_d}} \cdot (\sqrt{\Delta h_{avg}})$			
Dry gas meter calibration factor	<b>1.0100</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-0.92%</b>				
(must be within ± 5%)					

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Pellet Indurating Furnace Line 2 - Stack 1 (SV028)  
Control Module C-5

Test 1 - Baseline

Input Data	Symbol	Units	Run 1	Run 2	Run 3
Test date	-	-	10/3/2016	10/3/2016	10/4/2016
Test period	-	-	1035 - 1415	1505 - 1712	746 - 953
Total run time	t	min	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	91.5	92.7	91.0
Absolute average dry gas meter temp	T <sub>m</sub>	°F	68.3	76.8	56.1
Absolute average dry gas meter temp	T <sub>m</sub>	°R	528.0	536.4	515.7
Barometric pressure	P <sub>b</sub>	inches Hg	28.3	28.3	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	1.92	1.92	1.93
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	1.88	1.88	1.88
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	28.86	28.86	28.86
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	1.0209	1.0170	1.0190
Dry gas meter calibration factor	Y	Dimensionless	1.0100	1.0100	1.0100
Average of Y <sub>qa</sub> 's from test run series	<b>1.0190</b>	$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 \cdot T_m}{\Delta H_{@} (P_b + \frac{\Delta h_{avg}}{13.6} M_d)} \cdot \frac{29}{M_d}} \cdot (\sqrt{\Delta h_{avg}})$			
Dry gas meter calibration factor	<b>1.0100</b>				
% difference between average Y <sub>qa</sub> 's and Y	<b>-0.89%</b>				
(must be within ± 5%)					



## PYROMETER CALIBRATION

Pyrometer Number: C5 Date: 12/31/2015  
Pyrometer Reference: CL-3512-A Technician: MJN

Reference (°F)	Reference (°C)	Pyrometer ° F	
		Reading	Pass/Fail
1000	538	999	Pass
950	510	949	Pass
900	482	899	Pass
850	454	849	Pass
800	427	799	Pass
750	399	750	Pass
700	371	700	Pass
650	343	649	Pass
600	316	598	Pass
550	288	547	Pass
500	260	497	Pass
450	232	446	Pass
400	204	398	Pass
350	177	348	Pass
300	149	300	Pass
250	121	250	Pass
200	93	200	Pass
150	67	150	Pass
100	38	99	Pass
50	10	49	Pass
0	-18	1	Pass
-50	-46	-49	Pass

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

Technician signature:

QA signature:



## THERMOCOUPLE CALIBRATION

Meter In THERMOCOUPLE ID C5-I  
Cal Date: 1/4/2016

CALIBRATION TECHNICIAN: MJN

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

Pyrometer Reference

### TRACEABILITY

Report No. T15-1116-JC-2

Report No. 7060.00-205700-001

D-18

### DATE

11/16/2015

1/20/2016

### LABORATORY

NBS Calibrations

JM Test Systems

### Temperature Calibration Points

	20	70	150
Reference Deg F (To)	20	70	150
Probe Temp (deg F)	22.0	70.0	149.0
Difference (degrees)	2.0	0.0	1.0

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

YES

YES

YES

Technician signature

QA signature



## THERMOCOUPLE CALIBRATION

Meter Out

THERMOCOUPLE ID C5-O

Cal Date: 1/4/2016

CALIBRATION TECHNICIAN: MJN

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

Pyrometer Reference

### TRACEABILITY

Report No. T15-1116-JC-2

Report No. 7060.00-205700-001

D-18

### DATE

11/16/2015

1/20/2016

### LABORATORY

NBS Calibrations

JM Test Systems

### Temperature Calibration Points

Reference Deg F (To)

Probe Temp (deg F)

Difference (degrees)

20

20

22.0

2.0

70

70

70.0

0.0

150

150

149.0

1.0

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

YES

YES

YES

Technician signature

QA signature



# THERMOCOUPLE CALIBRATION

THERMOCOUPLE ID 10-3

Cal Date: 1/29/2016

Probe

CALIBRATION TECHNICIAN: RMP

## REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

## TRACEABILITY

Report No. T15-1116-JC-2

Report No. 7060.00-205700-001

## DATE

11/16/2015

1/20/2016

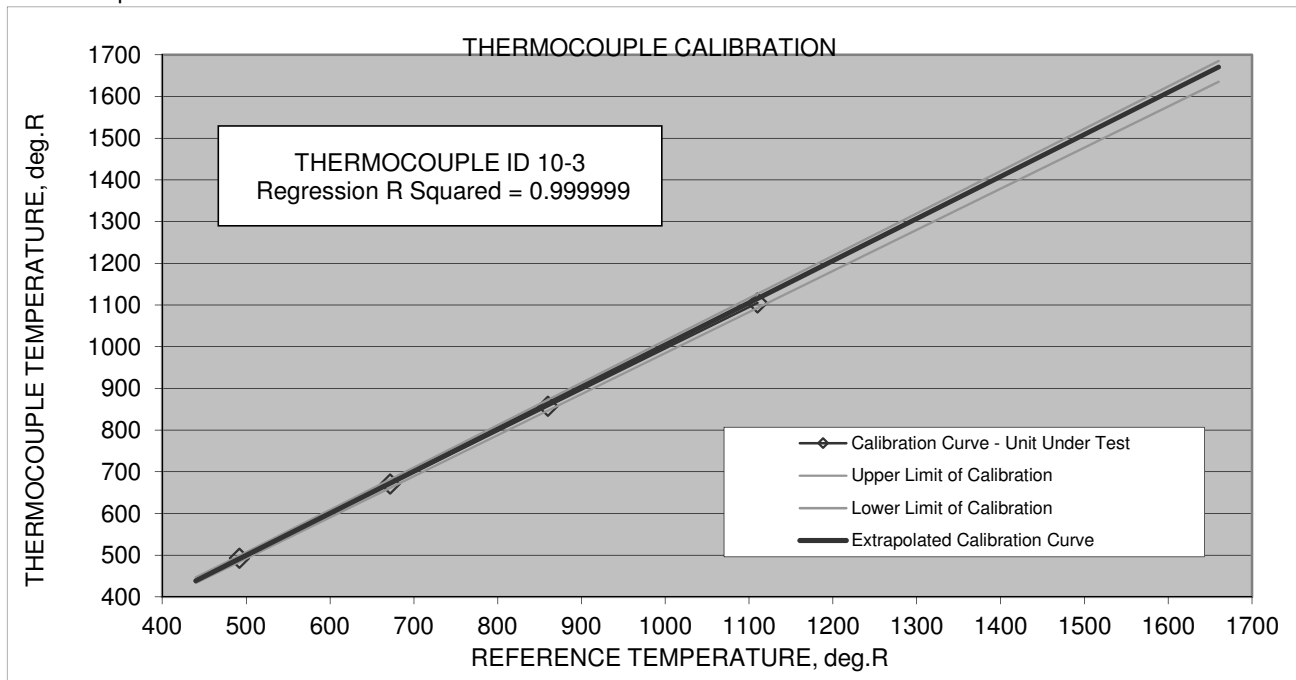
## LABORATORY

NBS Calibrations

JM Test Systems

## Temperature Calibration Points

	32	212	400	650	Ambient
Reference Deg F (To)	32	212	400	650	70
Probe Temp (deg F)	33	211	397	645	71
Reference Temp (deg R) deg F + 460	492	672	860	1110	530
Probe Temp (deg R), deg F + 460	493	671	857	1105	531
Difference (degrees)	-1	1	3	5	-1
% Diff Abs. T	0.2%	0.1%	0.3%	0.5%	0.2%
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:

Technician signature *[Signature]*

QA signature *David Heber*



# THERMOCOUPLE CALIBRATION

THERMOCOUPLE ID 10-4

Cal Date: 1/29/2016

Probe

CALIBRATION TECHNICIAN: RMP

## REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

## TRACEABILITY

Report No. T15-1116-JC-2

Report No. 7060.00-205700-001

## DATE

11/16/2015

1/20/2016

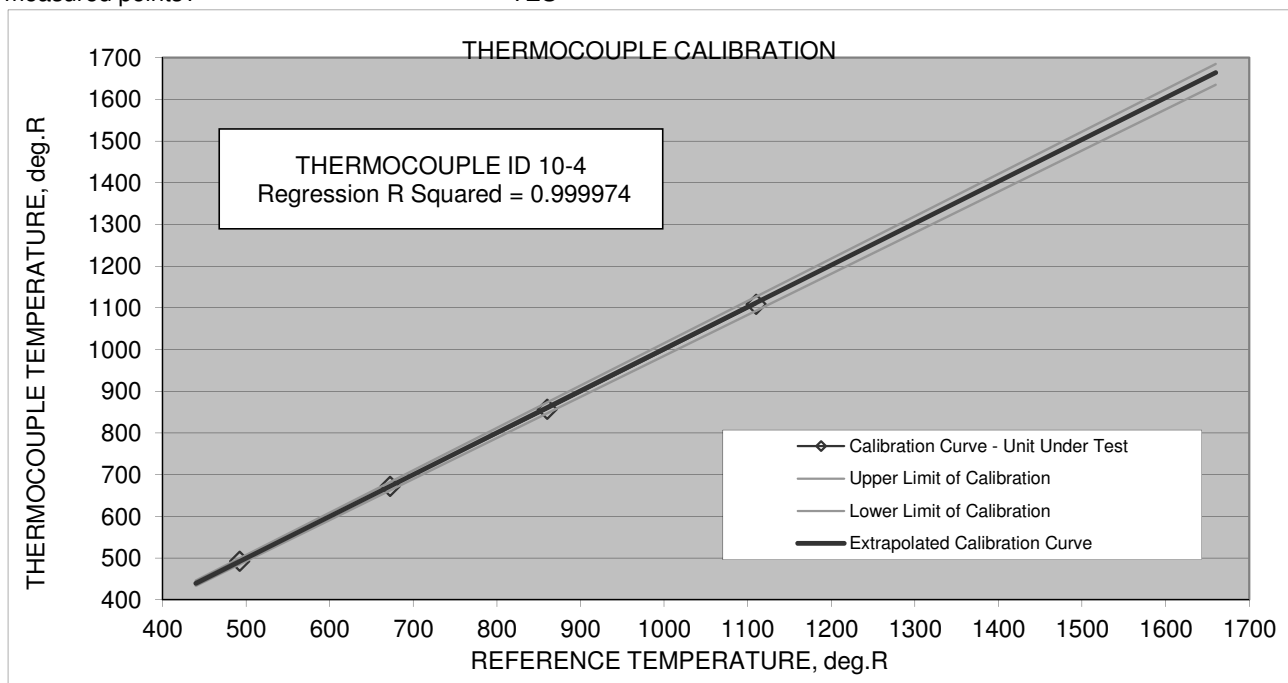
## LABORATORY

NBS Calibrations

JM Test Systems

## Temperature Calibration Points

	32	212	400	650	Ambient
Reference Deg F (To)	32	212	400	650	70
Probe Temp (deg F)	33	212	397	649	71
Reference Temp (deg R) deg F + 460	492	672	860	1110	530
Probe Temp (deg R), deg F + 460	493	672	857	1109	531
Difference (degrees)	-1	0	3	1	-1
% Diff Abs. T	0.2%	0.0%	0.3%	0.1%	0.2%
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:

Technician signature *[Signature]*

QA signature *[Signature]*





## S-Type Pitot Tube Geometry Check

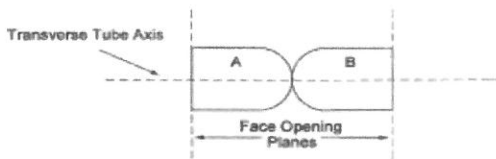
Pitot Tube Number: 10-4  
Length: 10 ft  
Function: M-5 Probe Free

Inspection Date: 1/6/16  
Technician: BAW

1. Are face openings perpendicular to tube axis?

☒ YES (go to 2)

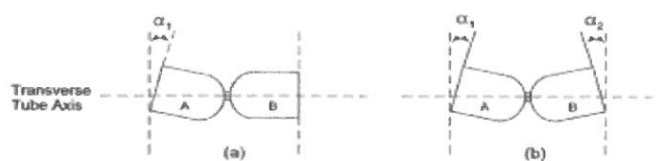
☐ NO (go to 1a)



1a. If NO, is angle less than 10°?

☐ YES (go to 2)

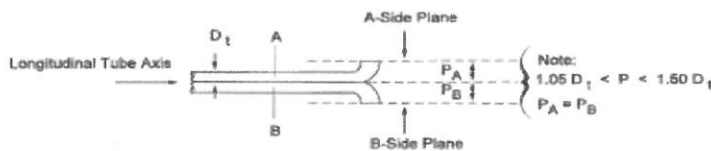
☐ NO (discontinue use)



2. Are face openings parallel to longitudinal axis?

☒ YES (go to 3)

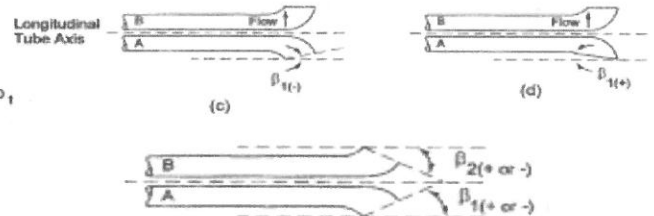
☐ NO (go to 2a)



2a. If NO, is angle less than 5°?

☐ YES (go to 3)

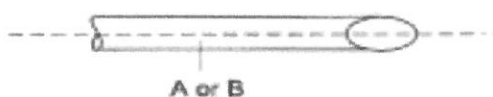
☐ NO (discontinue use)



3. Are legs of equal length?

☒ YES (go to 4)

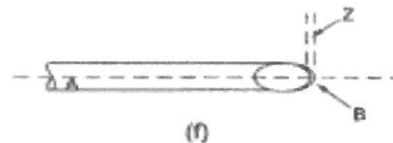
☐ NO (go to 3a)



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

☐ YES (go to 4)

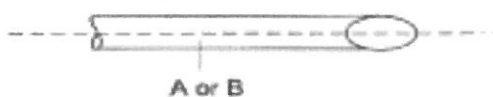
☐ NO (discontinue use)



4. Are center-lines of legs coincident?

☒ YES (go to 5)

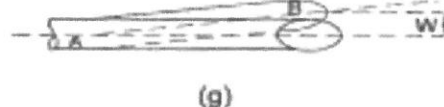
☐ NO (go to 4a)



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: [Signature]

Reviewed by: [Signature]



## S-Type Pitot Tube Geometry Check

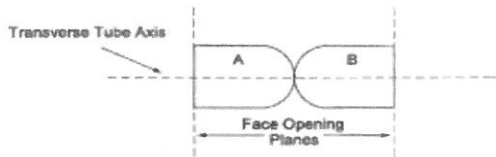
Pitot Tube Number: 10-3  
Length: 10 ft  
Function: M-5 Probe Free

Inspection Date: 1/6/16  
Technician: BAW

1. Are face openings perpendicular to tube axis?

☒ YES (go to 2)

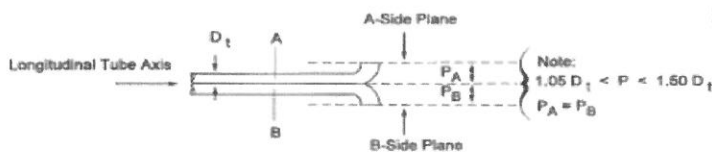
☐ NO (go to 1a)



2. Are face openings parallel to longitudinal axis?

☒ YES (go to 3)

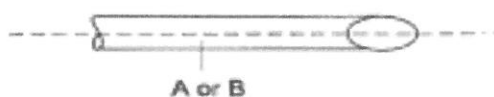
☐ NO (go to 2a)



3. Are legs of equal length?

☒ YES (go to 4)

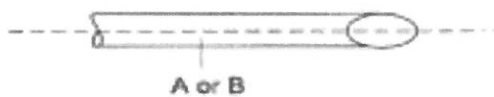
☐ NO (go to 3a)



4. Are center-lines of legs coincident?

☒ YES (go to 5)

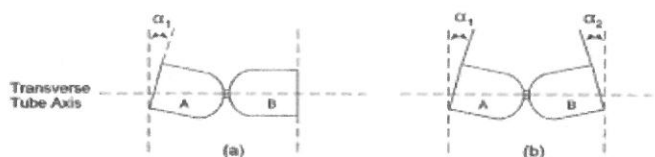
☐ NO (go to 4a)



1a. If NO, is angle less than 10°?

☐ YES (go to 2)

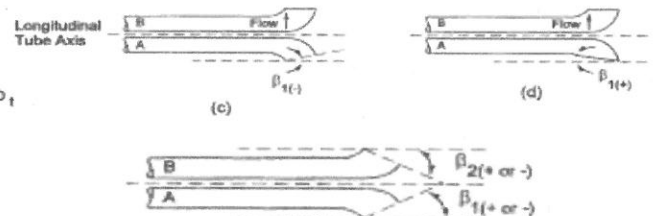
☐ NO (discontinue use)



2a. If NO, is angle less than 5°?

☐ YES (go to 3)

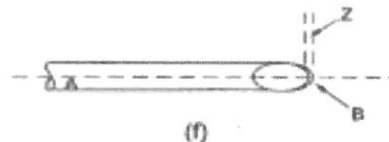
☐ NO (discontinue use)



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

☐ YES (go to 4)

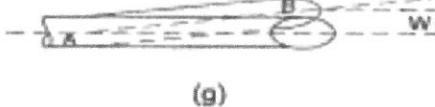
☐ NO (discontinue use)



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: [Signature]

Reviewed by: [Signature]



## THERMOCOUPLE CALIBRATION

Impinger Outlet

THERMOCOUPLE ID TIO-6001

Cal Date: 1/4/2016

Umbilical 100-3

CALIBRATION TECHNICIAN: MJN

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

Pryrometer Reference

### TRACEABILITY

Report No. T15-1116-JC-2

Report No. 7060.00-205700-001

D-18

### DATE

11/16/2015

1/20/2016

### LABORATORY

NBS Calibrations

JM Test Systems

### Temperature Calibration Points

Reference Deg F (To)

Probe Temp (deg F)

Difference (degrees)

20

70

150

20

70

150

21.0

70.0

150.0

1.0

0.0

0.0

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

YES

YES

YES

Technician signature

QA signature



## THERMOCOUPLE CALIBRATION

Impinger Outlet

THERMOCOUPLE ID TIO-6268

Cal Date: 1/26/2016

Umbilical 300-3

CALIBRATION TECHNICIAN: RMP

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

### TRACEABILITY

Report No. T15-1116-JC-2

Report No. 7060.00-205700-001

### DATE

11/16/2015

1/20/2016

### LABORATORY

NBS Calibrations

JM Test Systems

Temperature Calibration Points	20	70	150
Reference Deg F (To)	20	70	150
Probe Temp (deg F)	22.0	70.0	148.0
Difference (degrees)	2.0	0.0	2.0
TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)	YES	YES	YES

Technician signature

QA signature

Hibbing Taconite Company  
Hibbing, Minnesota

Barr Engineering Co.  
October 4, 2016

Nozzle Calibration  
Pellet Indurating Furnace Line 2 - Stack 4 (SV025)  
Test No. 4 - Baseline

Nozzle Calibration

Nozzle No. 

Glass
-------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches

1	0.222
2	0.222
3	0.222
Average	0.222

Test Date 10/4/2016  
Date Measured: 10/4/2016  
Technician: DJK

Hibbing Taconite Company  
Hibbing, Minnesota

Barr Engineering Co.  
January 3, 1900

Nozzle Calibration  
Pellet Indurating Furnace Line 2 - Stack 3 (SV026)  
Test No. 3 - Baseline

Nozzle Calibration  
Nozzle No. 

Glass
-------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches	
1	0.222
2	0.222
3	0.222
Average	0.222

Test Date 10/3/2016  
Date Measured: 10/3/2016  
Technician: DJK

Nozzle Calibration  
Pellet Indurating Furnace Line 2 - Stack 2 (SV027)  
Test No. 2 - Baseline

Nozzle Calibration

Nozzle No. 

Glass
-------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches

1	0.215
2	0.215
3	0.215
Average	0.215

Test Date 10/4/2016  
Date Measured: 10/4/2016  
Technician: DJK

Nozzle Calibration  
Pellet Indurating Furnace Line 2 - Stack 1 (SV028)  
Test No. 1 - Baseline

Nozzle Calibration  
Nozzle No. 

Glass
-------

Used for Runs: 

1
---

 - 

3
---

Point Measurement, inches	
1	0.215
2	0.215
3	0.215
Average	0.215

Test Date 10/3/2016  
Date Measured: 10/3/2016  
Technician: DJK





### 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.

Barometer: BA-23

		NWS Observation		Field Barometer			Barr Office				
Date	Technician	Time	Altimeter	ID	Time	Barometric Pressure	Station Pressure	Condition	Remarks		Offset
9/5/16	DJK	9:53	29.80	BA-23	10:37	28.34	28.34	In Calibration	As Found		0.00
10/10/16	DJK	8:45	30.03	BA-23	9:09	28.54	28.57	In Calibration	As Found		-0.03

## Appendix E

### Process Operating Data

Throughput  
wltph > dltp > dstph

Furnace Stacks Line #2

Baseline Testing - Stacks 1 and 3

Minimum Run 1		Minimum Run 2		Minimum Run 3	
Tag	ADBI3160	Tag	ADBI3160	Tag	ADBI3160
Start	10/3/2016 10:35	Start	10/3/2016 12:42	Start	10/4/2016 7:46
End	10/3/2016 11:08	End	10/3/2016 14:15	End	10/4/2016 9:53
03-Oct-16 10:35:00	468.9269714	03-Oct-16 15:05:00	472.5342712	04-Oct-16 07:46:00	449.1875916
03-Oct-16 10:50:00	469.7875977	03-Oct-16 15:20:00	467.004303	04-Oct-16 08:01:00	459.3319397
		03-Oct-16 15:35:00	459.7897339	04-Oct-16 08:16:00	447.9607544
		03-Oct-16 15:50:00	457.7388916	04-Oct-16 08:31:00	465.140457
03-Oct-16 12:42:00	480.9662902	03-Oct-16 16:05:00	458.9291077	04-Oct-16 08:46:00	462.5364075
03-Oct-16 12:57:00	478.6196912	03-Oct-16 16:20:00	447.8508911	04-Oct-16 09:01:00	455.8528442
03-Oct-16 13:12:00	477.2909316	03-Oct-16 16:35:00	456.3655396	04-Oct-16 09:16:00	463.3246007
03-Oct-16 13:27:00	476.0662367	03-Oct-16 16:50:00	454.2597656	04-Oct-16 09:31:00	452.5019226
03-Oct-16 13:42:00	481.8426475				
03-Oct-16 13:57:00	481.9053713				
Average	476.214338	Average	459.309063	Average	456.9795647
Maximum Run 1		Maximum Run 2		Maximum Run 3	
Tag	ADBI3160	Tag	ADBI3160	Tag	ADBI3160
Start	10/3/2016 10:35	Start	10/3/2016 15:05	Start	10/4/2016 7:46
End	10/3/2016 11:08	End	10/3/2016 17:12	End	10/4/2016 9:53
03-Oct-16 10:35:00	499.3783264	03-Oct-16 15:05:00	487.5310669	04-Oct-16 07:46:00	498.1881104
03-Oct-16 10:50:00	497.3824158	03-Oct-16 15:20:00	499.7994995	04-Oct-16 08:01:00	512.9102173
		03-Oct-16 15:35:00	495.4597473	04-Oct-16 08:16:00	501.1911316
		03-Oct-16 15:50:00	489.3987732	04-Oct-16 08:31:00	495.8809204
03-Oct-16 12:42:00	501.8686523	03-Oct-16 16:05:00	498.7740784	04-Oct-16 08:46:00	490.9002991
03-Oct-16 12:57:00	493.0363182	03-Oct-16 16:20:00	491.3946838	04-Oct-16 09:01:00	497.6571045
03-Oct-16 13:12:00	494.4343262	03-Oct-16 16:35:00	498.3162842	04-Oct-16 09:16:00	491.9806519
03-Oct-16 13:27:00	489.6185303	03-Oct-16 16:50:00	490.5718514	04-Oct-16 09:31:00	500.9897156
03-Oct-16 13:42:00	502.4729004				
03-Oct-16 13:57:00	508.9733582				
Average	496.8844956	Average	493.9057481	Average	498.7122688
Average Run 1		Average Run 2		Average Run 3	
Tag	ADBI3160	Tag	ADBI3160	Tag	ADBI3160
Start	10/3/2016 10:35	Start	10/3/2016 15:05	Start	10/4/2016 7:46
End	10/3/2016 11:08	End	10/3/2016 17:12	End	10/4/2016 9:53
03-Oct-16 10:35:00	480.4154586	03-Oct-16 15:05:00	477.7495527	04-Oct-16 07:46:00	480.3953604
03-Oct-16 10:50:00	484.405285	03-Oct-16 15:20:00	480.555629	04-Oct-16 08:01:00	481.1926562
		03-Oct-16 15:35:00	476.3751525	04-Oct-16 08:16:00	474.9007765
		03-Oct-16 15:50:00	473.7736312	04-Oct-16 08:31:00	482.6810059
03-Oct-16 12:42:00	480.9662902	03-Oct-16 16:05:00	479.7498387	04-Oct-16 08:46:00	475.3986376
03-Oct-16 12:57:00	478.6196912	03-Oct-16 16:20:00	471.4083763	04-Oct-16 09:01:00	477.9782349
03-Oct-16 13:12:00	477.2909316	03-Oct-16 16:35:00	474.9060916	04-Oct-16 09:16:00	479.7010372
03-Oct-16 13:27:00	476.0662367	03-Oct-16 16:50:00	471.9309277	04-Oct-16 09:31:00	476.7384172
03-Oct-16 13:42:00	481.8426475				
03-Oct-16 13:57:00	481.9053713				
Average	374 dltp 419 dshtp	Average	371 dltp 416 dshtp	Average	373 dltp 418 dshtp
				Average	
				373 dltp 418 dshtp	

Throughput  
wltph > dltp > dstph

Furnace Stacks Line #2

Baseline Testing - Stacks 2 and 4

**Minimum**  
**Run 1**  
**Tag** ADBI3160  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	460.8700867
04-Oct-16 10:38:00	463.5618286
04-Oct-16 10:53:00	454.790802
04-Oct-16 11:08:00	454.3330078
04-Oct-16 11:23:00	463.6900024
04-Oct-16 11:38:00	455.7246704
04-Oct-16 11:53:00	462.4540822
04-Oct-16 12:08:00	453.1427917

**Average** 458.570909

**Maximum**  
**Run 1**  
**Tag** ADBI3160  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	498.1881104
04-Oct-16 10:38:00	504.334514
04-Oct-16 10:53:00	504.6702576
04-Oct-16 11:08:00	495.6062622
04-Oct-16 11:23:00	493.2990417
04-Oct-16 11:38:00	499.1402893
04-Oct-16 11:53:00	488.8128357
04-Oct-16 12:08:00	498.5543518

**Average** 497.8257078

**Average**  
**Run 1**  
**Tag** ADBI3160  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	478.5661619
04-Oct-16 10:38:00	481.9484075
04-Oct-16 10:53:00	478.0844328
04-Oct-16 11:08:00	477.1902376
04-Oct-16 11:23:00	479.2064817
04-Oct-16 11:38:00	479.1497768
04-Oct-16 11:53:00	472.8464242
04-Oct-16 12:08:00	474.1536925

**Average** 373 dltp  
417 dshtp

**Minimum**  
**Run 2**  
**Tag** ADBI3160  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	455.4316711
04-Oct-16 13:11:00	451.6412964
04-Oct-16 13:26:00	429.2834167
04-Oct-16 13:41:00	452.5934753
04-Oct-16 13:56:00	444.8478699
04-Oct-16 14:11:00	448.6565857
04-Oct-16 14:26:00	452.9779968
04-Oct-16 14:41:00	449.2608337

**Average** 448.0866432

**Maximum**  
**Run 2**  
**Tag** ADBI3160  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	489.4959993
04-Oct-16 13:11:00	493.8483887
04-Oct-16 13:26:00	492.6522782
04-Oct-16 13:41:00	496.9063416
04-Oct-16 13:56:00	502.0334473
04-Oct-16 14:11:00	495.5696411
04-Oct-16 14:26:00	491.9989624
04-Oct-16 14:41:00	484.9125671

**Average** 493.4272032

**Average**  
**Run 2**  
**Tag** ADBI3160  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	471.644885
04-Oct-16 13:11:00	474.6719682
04-Oct-16 13:26:00	470.0282781
04-Oct-16 13:41:00	474.422024
04-Oct-16 13:56:00	479.6470583
04-Oct-16 14:11:00	471.7392256
04-Oct-16 14:26:00	478.3588276
04-Oct-16 14:41:00	471.6089566

**Average** 370 dltp  
414 dshtp

**Minimum**  
**Run 3**  
**Tag** ADBI3160  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	454.6626282
05-Oct-16 08:00:00	457.9219971
05-Oct-16 08:15:00	450.4876709
05-Oct-16 08:30:00	462.1152344
05-Oct-16 08:45:00	457.7755127
05-Oct-16 09:00:00	449.9017334
05-Oct-16 09:15:00	453.4906921
05-Oct-16 09:30:00	446.2028809

**Average** 454.0697937

**Maximum**  
**Run 3**  
**Tag** ADBI3160  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	491.7792358
05-Oct-16 08:00:00	492.9328308
05-Oct-16 08:15:00	492.1271362
05-Oct-16 08:30:00	491.9849498
05-Oct-16 08:45:00	498.9205627
05-Oct-16 09:00:00	497.1993103
05-Oct-16 09:15:00	486.5422668
05-Oct-16 09:30:00	495.6611938

**Average** 493.3934358

**Average**  
**Run 3**  
**Tag** ADBI3160  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	472.4132508
05-Oct-16 08:00:00	479.426368
05-Oct-16 08:15:00	476.4395048
05-Oct-16 08:30:00	474.8839437
05-Oct-16 08:45:00	476.9151151
05-Oct-16 09:00:00	474.2954738
05-Oct-16 09:15:00	476.1027235
05-Oct-16 09:30:00	474.5217478

**Average** 371 dltp  
416 dshtp

**Average** 371 dltp  
416 dshtp

Mill Line #7  
Mill Input  
wltph > dltpH > dstph

Furnace Stacks Line #2

**Natural Gas Usage**

**Baseline Testing - Stacks 1 and 3**

**North Chamber**

**Run 1**

**Tag** ADBI3109  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 60.09936655  
03-Oct-16 10:50:00 60.14474315  
  
03-Oct-16 12:42:00 59.63188653  
03-Oct-16 12:57:00 59.07177019  
03-Oct-16 13:12:00 58.51165384  
03-Oct-16 13:27:00 58.0133917  
03-Oct-16 13:42:00 58.04928234  
03-Oct-16 13:57:00 58.2083391

**Average** 59.0745849

**North Chamber**

**Run 2**

**Tag** ADBI3109  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 57.53463036  
03-Oct-16 15:20:00 57.2966611  
03-Oct-16 15:35:00 57.08186557  
03-Oct-16 15:50:00 57.16194952  
03-Oct-16 16:05:00 57.33155276  
03-Oct-16 16:20:00 57.5011156  
03-Oct-16 16:35:00 57.67075923  
03-Oct-16 16:50:00 57.79083172

**Average** 57

**North Chamber**

**Run 3**

**Tag** ADBI3109  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 59.35998566  
04-Oct-16 08:01:00 58.82563932  
04-Oct-16 08:16:00 58.29129298  
04-Oct-16 08:31:00 57.75694664  
04-Oct-16 08:46:00 57.22260031  
04-Oct-16 09:01:00 56.72623559  
04-Oct-16 09:16:00 56.73128826  
04-Oct-16 09:31:00 56.89210758

**Average** 58 **Total Average** 58

**South Chamber**

**Run 1**

**Tag** ADBI3108  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:10

03-Oct-16 10:35:00 40.41324688  
03-Oct-16 10:50:00 40.46280288  
  
03-Oct-16 12:42:00 40.96320321  
03-Oct-16 12:57:00 40.54291857  
03-Oct-16 13:12:00 40.45734455  
03-Oct-16 13:27:00 40.37177052  
03-Oct-16 13:42:00 40.2861965  
03-Oct-16 13:57:00 40.20062247

**Average** 40.49964044

**South Chamber**

**Run 2**

**Tag** ADBI3108  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 39.88678759  
03-Oct-16 15:20:00 39.93534851  
03-Oct-16 15:35:00 39.98390943  
03-Oct-16 15:50:00 40.03247035  
03-Oct-16 16:05:00 40.08103127  
03-Oct-16 16:20:00 40.12959219  
03-Oct-16 16:35:00 40.17815311  
03-Oct-16 16:50:00 40.22671403

**Average** 40

**South Chamber**

**Run 3**

**Tag** ADBI3108  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 43.77463218  
04-Oct-16 08:01:00 43.64894909  
04-Oct-16 08:16:00 43.52326599  
04-Oct-16 08:31:00 43.3975829  
04-Oct-16 08:46:00 43.2718998  
04-Oct-16 09:01:00 43.1361379  
04-Oct-16 09:16:00 42.98758171  
04-Oct-16 09:31:00 42.83898127

**Average** 43 **Total Average** 41

**Total (MCF/hr)** 100  
Heat Content  
(MMBtu/MCF) 1.044  
Heat Input  
(MMBtu/hr) 104

**Total (MCF/hr)** 97  
Heat Content  
(MMBtu/MCF) 1.044  
Heat Input  
(MMBtu/hr) 102

**Total (MCF/hr)** 101 **Total (MCF/hr)** 99  
Heat Content  
(MMBtu/MCF) 1.045 (MMBtu/MCF) 1.04  
Heat Input  
(MMBtu/hr) 106 (MMBtu/hr) 104

Mill Line #7  
 Mill Input  
 wltph > dltpH > dstph

Furnace Stacks Line #2

Natural Gas Usage

Baseline Testing - Stacks 2 and 4

North Chamber

Run 1

Tag ADBI3109  
 Start 10/4/2016 10:23  
 End 10/4/2016 12:28

04-Oct-16 10:23:00	56.30125064
04-Oct-16 10:38:00	56.24137687
04-Oct-16 10:53:00	56.18334157
04-Oct-16 11:08:00	56.12530626
04-Oct-16 11:23:00	56.06727096
04-Oct-16 11:38:00	56.00923566
04-Oct-16 11:53:00	55.95058016
04-Oct-16 12:08:00	55.87847349

Average 56.09460445

South Chamber

Run 1

Tag ADBI3108  
 Start 10/4/2016 10:23  
 End 10/4/2016 12:28

04-Oct-16 10:23:00	42.55061307
04-Oct-16 10:38:00	42.80924577
04-Oct-16 10:53:00	43.06787847
04-Oct-16 11:08:00	43.31602398
04-Oct-16 11:23:00	43.30384935
04-Oct-16 11:38:00	43.1792122
04-Oct-16 11:53:00	43.05457505
04-Oct-16 12:08:00	42.65382874

Average 42.99190333

Total (MCF/hr)

99

Heat Content

(MMBtu/MCF) 1.045

Heat Input

(MMBtu/hr) 104

North Chamber

Run 2

Tag ADBI3109  
 Start 10/4/2016 12:56  
 End 10/4/2016 15:03

04-Oct-16 12:56:00	56.29447429
04-Oct-16 13:11:00	56.65328728
04-Oct-16 13:26:00	56.61313444
04-Oct-16 13:41:00	56.42336883
04-Oct-16 13:56:00	56.27838592
04-Oct-16 14:11:00	56.24418797
04-Oct-16 14:26:00	56.21515542
04-Oct-16 14:41:00	56.14185549

Average 56

South Chamber

Run 2

Tag ADBI3108  
 Start 10/4/2016 12:56  
 End 10/4/2016 15:03

04-Oct-16 12:56:00	42.46752791
04-Oct-16 13:11:00	42.64218222
04-Oct-16 13:26:00	42.51270096
04-Oct-16 13:41:00	42.3832197
04-Oct-16 13:56:00	42.25373844
04-Oct-16 14:11:00	42.12425718
04-Oct-16 14:26:00	41.99477593
04-Oct-16 14:41:00	41.86529467

Average 42

Total (MCF/hr)

99

Heat Content

(MMBtu/MCF) 1.045

Heat Input

(MMBtu/hr) 103

North Chamber

Run 3

Tag ADBI3109  
 Start 10/5/2016 7:45  
 End 10/5/2016 9:50

05-Oct-16 07:45:00	55.94183414
05-Oct-16 08:00:00	55.99932124
05-Oct-16 08:15:00	56.05680835
05-Oct-16 08:30:00	56.03944867
05-Oct-16 08:45:00	55.97570831
05-Oct-16 09:00:00	56.02331038
05-Oct-16 09:15:00	56.08023889
05-Oct-16 09:30:00	56.13716739

Average 56 Total Average 56

South Chamber

Run 3

Tag ADBI3108  
 Start 10/5/2016 7:45  
 End 10/5/2016 9:50

05-Oct-16 07:45:00	41.69118785
05-Oct-16 08:00:00	41.74674007
05-Oct-16 08:15:00	41.80229228
05-Oct-16 08:30:00	41.85784449
05-Oct-16 08:45:00	41.9133967
05-Oct-16 09:00:00	41.96894892
05-Oct-16 09:15:00	42.00187314
05-Oct-16 09:30:00	41.98780952

Average 42 Total Average 42

Total (MCF/hr)

98 Total (MCF/hr) 99

Heat Content

Heat Content

(MMBtu/MCF) 1.041 (MMBtu/MCF) 1.04

Heat Input

Heat Input

(MMBtu/hr) 102 (MMBtu/hr) 103

## Pressure Drop - Inches of Water Column

Furnace Stacks Line #2**Baseline Testing - Stack 1****Minimum  
Run 1**

**Tag** ADBI3709  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 3.72938323  
 03-Oct-16 10:50:00 3.701207399  
  
 03-Oct-16 12:42:00 3.606374733  
 03-Oct-16 12:57:00 3.619618654  
 03-Oct-16 13:12:00 3.620153242  
 03-Oct-16 13:27:00 3.665983809  
 03-Oct-16 13:42:00 3.642846584  
 03-Oct-16 13:57:00 3.641777251

**Average** 3.7

**Minimum  
Run 2**

**Tag** ADBI3709  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 3.62210165  
 03-Oct-16 15:20:00 3.635636568  
 03-Oct-16 15:35:00 3.555321932  
 03-Oct-16 15:50:00 3.645049918  
 03-Oct-16 16:05:00 3.674792748  
 03-Oct-16 16:20:00 3.647614686  
 03-Oct-16 16:35:00 3.598854542  
 03-Oct-16 16:50:00 3.597200871

**Average** 3.6

**Minimum  
Run 3**

**Tag** ADBI3709  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 3.710116802  
 04-Oct-16 08:01:00 3.698594332  
 04-Oct-16 08:16:00 3.747419726  
 04-Oct-16 08:31:00 3.730777524  
 04-Oct-16 08:46:00 3.699521542  
 04-Oct-16 09:01:00 3.752914508  
 04-Oct-16 09:16:00 3.726548672  
 04-Oct-16 09:31:00 3.718062227

**Average** 3.7 **Total Average** 3.7

**Maximum  
Run 1**

**Tag** ADBI3709  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 3.833825588  
 03-Oct-16 10:50:00 3.942840815  
  
 03-Oct-16 12:42:00 3.731424332  
 03-Oct-16 12:57:00 3.730584502  
 03-Oct-16 13:12:00 3.665983809  
 03-Oct-16 13:27:00 3.75972724  
 03-Oct-16 13:42:00 3.76844573  
 03-Oct-16 13:57:00 3.668901682

**Average** 3.8

**Maximum  
Run 2**

**Tag** ADBI3709  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 3.754513025  
 03-Oct-16 15:20:00 3.749591827  
 03-Oct-16 15:35:00 3.665283474  
 03-Oct-16 15:50:00 3.6959939  
 03-Oct-16 16:05:00 3.735898018  
 03-Oct-16 16:20:00 3.701670408  
 03-Oct-16 16:35:00 3.732800722  
 03-Oct-16 16:50:00 3.745774031

**Average** 3.7

**Maximum  
Run 3**

**Tag** ADBI3709  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 3.764345724  
 04-Oct-16 08:01:00 3.747419726  
 04-Oct-16 08:16:00 3.827112624  
 04-Oct-16 08:31:00 3.842294693  
 04-Oct-16 08:46:00 3.770286116  
 04-Oct-16 09:01:00 3.786468983  
 04-Oct-16 09:16:00 3.752914508  
 04-Oct-16 09:31:00 3.764129162

**Average** 3.8 **Total Average** 3.8

**Average  
Run 1**

**Tag** ADBI3709  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 3.784638636  
 03-Oct-16 10:50:00 3.81583946  
  
 03-Oct-16 12:42:00 3.683878954  
 03-Oct-16 12:57:00 3.656440801  
 03-Oct-16 13:12:00 3.634846462  
 03-Oct-16 13:27:00 3.724250781  
 03-Oct-16 13:42:00 3.697977347  
 03-Oct-16 13:57:00 3.656392375

**Average** 3.7

**Average  
Run 2**

**Tag** ADBI3709  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 3.665333558  
 03-Oct-16 15:20:00 3.695533918  
 03-Oct-16 15:35:00 3.604391245  
 03-Oct-16 15:50:00 3.681400681  
 03-Oct-16 16:05:00 3.705810227  
 03-Oct-16 16:20:00 3.691972659  
 03-Oct-16 16:35:00 3.661066968  
 03-Oct-16 16:50:00 3.66458153

**Average** 3.7 in H2O

**Average  
Run 3**

**Tag** ADBI3709  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 3.728078511  
 04-Oct-16 08:01:00 3.721725712  
 04-Oct-16 08:16:00 3.776535504  
 04-Oct-16 08:31:00 3.800472575  
 04-Oct-16 08:46:00 3.7332379  
 04-Oct-16 09:01:00 3.773430567  
 04-Oct-16 09:16:00 3.734460213  
 04-Oct-16 09:31:00 3.745103999

**Average** 3.8 **Total Average** 3.7

Furnace Stacks Line #2**Baseline Testing - Stack 1****Minimum  
Run 1**

**Tag** ADBI3711  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 338.9887085  
 03-Oct-16 10:50:00 341.9093933  
  
 03-Oct-16 12:42:00 342.6544495  
 03-Oct-16 12:57:00 353.4728699  
 03-Oct-16 13:12:00 351.1482544  
 03-Oct-16 13:27:00 349.9263  
 03-Oct-16 13:42:00 345.9923706  
**03-Oct-16 13:57:00** 347.1844788

**Average** 346

**Minimum  
Run 2**

**Tag** ADBI3711  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 345.1280518  
 03-Oct-16 15:20:00 339.6443787  
 03-Oct-16 15:35:00 351.1780396  
 03-Oct-16 15:50:00 349.8965149  
 03-Oct-16 16:05:00 351.8854855  
 03-Oct-16 16:20:00 352.1317139  
 03-Oct-16 16:35:00 346.4096069  
 03-Oct-16 16:50:00 349.8070984

**Average** 348

**Minimum  
Run 3**

**Tag** ADBI3711  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 346.1115723  
 04-Oct-16 08:01:00 348.6746216  
 04-Oct-16 08:16:00 342.5948181  
 04-Oct-16 08:31:00 346.7374268  
 04-Oct-16 08:46:00 344.442627  
 04-Oct-16 09:01:00 344.1445923  
 04-Oct-16 09:16:00 348.0785828  
 04-Oct-16 09:31:00 354.0689087

**Average** 347 **Total Average** 347

**Maximum  
Run 1**

**Tag** ADBI3711  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 375.1990967  
 03-Oct-16 10:50:00 374.7520447  
  
 03-Oct-16 12:42:00 378.2091675  
 03-Oct-16 12:57:00 378.2091675  
 03-Oct-16 13:12:00 376.5401917  
 03-Oct-16 13:27:00 375.8249512  
 03-Oct-16 13:42:00 375.8249512  
**03-Oct-16 13:57:00** 367.9272156

**Average** 375

**Maximum  
Run 2**

**Tag** ADBI3711  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 359.4631958  
 03-Oct-16 15:20:00 363.0097351  
 03-Oct-16 15:35:00 360.0890808  
 03-Oct-16 15:50:00 371.8313599  
 03-Oct-16 16:05:00 361.6984253  
 03-Oct-16 16:20:00 368.7318726  
 03-Oct-16 16:35:00 364.7979431  
 03-Oct-16 16:50:00 367.8973999

**Average** 365

**Maximum  
Run 3**

**Tag** ADBI3711  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 359.2843933  
 04-Oct-16 08:01:00 374.543457  
 04-Oct-16 08:16:00 365.3343811  
 04-Oct-16 08:31:00 365.2747803  
 04-Oct-16 08:46:00 374.2454224  
 04-Oct-16 09:01:00 364.0826416  
 04-Oct-16 09:16:00 366.3178406  
 04-Oct-16 09:31:00 371.0267029

**Average** 368 **Total Average** 369

**Average****Run 1**

**Tag** ADBI3711  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 362.3479403  
 03-Oct-16 10:50:00 357.2819409  
  
 03-Oct-16 12:42:00 361.4343052  
 03-Oct-16 12:57:00 363.8966478  
 03-Oct-16 13:12:00 362.0643973  
 03-Oct-16 13:27:00 361.551786  
 03-Oct-16 13:42:00 361.4945442  
**03-Oct-16 13:57:00** 356.3490384

**Average** 361 gpm

**Average****Run 2**

**Tag** ADBI3711  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 351.448715  
 03-Oct-16 15:20:00 353.764409  
 03-Oct-16 15:35:00 355.778334  
 03-Oct-16 15:50:00 355.3914846  
 03-Oct-16 16:05:00 355.223653  
 03-Oct-16 16:20:00 357.9652973  
 03-Oct-16 16:35:00 354.337279  
 03-Oct-16 16:50:00 356.9065637

**Average** 355 gpm

**Average****Run 3**

**Tag** ADBI3711  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 353.3828593  
 04-Oct-16 08:01:00 356.8126059  
 04-Oct-16 08:16:00 354.1029019  
 04-Oct-16 08:31:00 359.1421163  
 04-Oct-16 08:46:00 356.2772111  
 04-Oct-16 09:01:00 352.9190131  
 04-Oct-16 09:16:00 356.7637828  
 04-Oct-16 09:31:00 361.3001246

**Average** 356 **Total Average** 358



## Pressure Drop - Inches of Water Column

Furnace Stacks Line #2**Baseline Testing - Stack 2****Minimum  
Run 1**

**Tag** ADBI3712  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	4.26804022
04-Oct-16 10:38:00	4.293920636
04-Oct-16 10:53:00	4.26008749
04-Oct-16 11:08:00	4.27544956
04-Oct-16 11:23:00	4.251628399
04-Oct-16 11:38:00	4.258538572
04-Oct-16 11:53:00	4.18774172
04-Oct-16 12:08:00	4.182157516

**Average** 4.247195514

**Maximum  
Run 1**

**Tag** ADBI3712  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	4.293920636
04-Oct-16 10:38:00	4.321464539
04-Oct-16 10:53:00	4.313319108
04-Oct-16 11:08:00	4.316875935
04-Oct-16 11:23:00	4.27544956
04-Oct-16 11:38:00	4.277067184
04-Oct-16 11:53:00	4.258538572
04-Oct-16 12:08:00	4.226287842

**Average** 4.285365422

**Average  
Run 1**

**Tag** ADBI3712  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	4.282621472
04-Oct-16 10:38:00	4.30750641
04-Oct-16 10:53:00	4.28315385
04-Oct-16 11:08:00	4.299638418
04-Oct-16 11:23:00	4.263456533
04-Oct-16 11:38:00	4.269299317
04-Oct-16 11:53:00	4.231513474
04-Oct-16 12:08:00	4.207141129

**Average** 4.268041325

**Minimum  
Run 2**

**Tag** ADBI3712  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	4.176364602
04-Oct-16 13:11:00	4.143419266
04-Oct-16 13:26:00	4.156414482
04-Oct-16 13:41:00	4.152276039
04-Oct-16 13:56:00	4.144687176
04-Oct-16 14:11:00	4.156690677
04-Oct-16 14:26:00	4.140041828
04-Oct-16 14:41:00	4.075836182

**Average** 4.1

**Maximum  
Run 2**

**Tag** ADBI3712  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	4.239909172
04-Oct-16 13:11:00	4.176364602
04-Oct-16 13:26:00	4.179161549
04-Oct-16 13:41:00	4.197202351
04-Oct-16 13:56:00	4.218082428
04-Oct-16 14:11:00	4.275226116
04-Oct-16 14:26:00	4.210352421
04-Oct-16 14:41:00	4.147219901

**Average** 4.2

**Average  
Run 2**

**Tag** ADBI3712  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	4.214208476
04-Oct-16 13:11:00	4.15636633
04-Oct-16 13:26:00	4.170092597
04-Oct-16 13:41:00	4.1666758
04-Oct-16 13:56:00	4.184055792
04-Oct-16 14:11:00	4.21922022
04-Oct-16 14:26:00	4.174289244
04-Oct-16 14:41:00	4.101833164

**Average** 4.2

**Minimum  
Run 3**

**Tag** ADBI3712  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	4.176752567
05-Oct-16 08:00:00	4.207244396
05-Oct-16 08:15:00	4.223003542
05-Oct-16 08:30:00	4.214792728
05-Oct-16 08:45:00	4.222037551
05-Oct-16 09:00:00	4.217903614
05-Oct-16 09:15:00	4.210209846
05-Oct-16 09:30:00	4.20945837

**Average** 4.2 **Total Average** 4.2

**Maximum  
Run 3**

**Tag** ADBI3712  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	4.226608985
05-Oct-16 08:00:00	4.238541126
05-Oct-16 08:15:00	4.259546757
05-Oct-16 08:30:00	4.245006223
05-Oct-16 08:45:00	4.239747047
05-Oct-16 09:00:00	4.254074097
05-Oct-16 09:15:00	4.24177997
05-Oct-16 09:30:00	4.238826275

**Average** 4.2 **Total Average** 4.2

**Average  
Run 3**

**Tag** ADBI3712  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	4.198315757
05-Oct-16 08:00:00	4.22257742
05-Oct-16 08:15:00	4.247133253
05-Oct-16 08:30:00	4.228229427
05-Oct-16 08:45:00	4.231040748
05-Oct-16 09:00:00	4.235954732
05-Oct-16 09:15:00	4.223580071
05-Oct-16 09:30:00	4.227163458

**Average** 4.2 **Total Average** 4.2

Furnace Stacks Line #2**Baseline Testing - Stack 2****Minimum****Run 1**

**Tag** ADBI3714  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00 301.2583923  
 04-Oct-16 10:38:00 312.2556152  
 04-Oct-16 10:53:00 310.1992493  
 04-Oct-16 11:08:00 307.2487488  
 04-Oct-16 11:23:00 310.5277136  
 04-Oct-16 11:38:00 305.6096191  
 04-Oct-16 11:53:00 310.8363873  
 04-Oct-16 12:08:00 306.2950745

**Average** 308

**Maximum****Run 1**

**Tag** ADBI3714  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00 323.2826233  
 04-Oct-16 10:38:00 318.2161865  
 04-Oct-16 10:53:00 312.529192  
 04-Oct-16 11:08:00 333.4155579  
 04-Oct-16 11:23:00 313.8356899  
 04-Oct-16 11:38:00 315.1464844  
 04-Oct-16 11:53:00 325.0112  
 04-Oct-16 12:08:00 310.8363873

**Average** 319

**Average****Run 1**

**Tag** ADBI3714  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00 312.9165631  
 04-Oct-16 10:38:00 314.5981124  
 04-Oct-16 10:53:00 310.9373446  
 04-Oct-16 11:08:00 317.1302128  
 04-Oct-16 11:23:00 312.0098161  
 04-Oct-16 11:38:00 312.492735  
 04-Oct-16 11:53:00 315.6417594  
 04-Oct-16 12:08:00 308.449723

**Average** 313

**Minimum****Run 2**

**Tag** ADBI3714  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00 310.3163503  
 04-Oct-16 13:11:00 306.7420959  
 04-Oct-16 13:26:00 307.6689952  
 04-Oct-16 13:41:00 300.6921387  
 04-Oct-16 13:56:00 308.579382  
 04-Oct-16 14:11:00 290.1121521  
 04-Oct-16 14:26:00 288.5624084  
 04-Oct-16 14:41:00 303.9108582

**Average** 302

**Maximum****Run 2**

**Tag** ADBI3714  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00 325.1900024  
 04-Oct-16 13:11:00 320.5130294  
 04-Oct-16 13:26:00 322.5673828  
 04-Oct-16 13:41:00 319.4082947  
 04-Oct-16 13:56:00 313.9590955  
 04-Oct-16 14:11:00 314.2226257  
 04-Oct-16 14:26:00 326.9483948  
 04-Oct-16 14:41:00 324.4350548

**Average** 321

**Average****Run 2**

**Tag** ADBI3714  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00 316.4871634  
 04-Oct-16 13:11:00 311.8254055  
 04-Oct-16 13:26:00 315.8610552  
 04-Oct-16 13:41:00 311.9365994  
 04-Oct-16 13:56:00 310.925504  
 04-Oct-16 14:11:00 302.2994931  
 04-Oct-16 14:26:00 306.3541831  
 04-Oct-16 14:41:00 312.2849978

**Average** 311

**Minimum****Run 3**

**Tag** ADBI3714  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00 308.4125458  
 05-Oct-16 08:00:00 306.004995  
 05-Oct-16 08:15:00 305.0731506  
 05-Oct-16 08:30:00 301.9736633  
 05-Oct-16 08:45:00 304.5664978  
 05-Oct-16 09:00:00 306.7719116  
 05-Oct-16 09:15:00 311.9407498  
 05-Oct-16 09:30:00 306.3546753

**Average** 306 **Total Average** 305

**Maximum****Run 3**

**Tag** ADBI3714  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00 319.7062988  
 05-Oct-16 08:00:00 313.0371136  
 05-Oct-16 08:15:00 317.3816833  
 05-Oct-16 08:30:00 317.7095337  
 05-Oct-16 08:45:00 322.0309448  
 05-Oct-16 09:00:00 324.8025818  
 05-Oct-16 09:15:00 320.0043335  
 05-Oct-16 09:30:00 312.1661987

**Average** 318 **Total Average** 317

**Average****Run 3**

**Tag** ADBI3714  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00 315.0500101  
 05-Oct-16 08:00:00 309.2118682  
 05-Oct-16 08:15:00 311.2510652  
 05-Oct-16 08:30:00 311.3284819  
 05-Oct-16 08:45:00 312.9156987  
 05-Oct-16 09:00:00 314.5642053  
 05-Oct-16 09:15:00 317.4213529  
 05-Oct-16 09:30:00 309.6031066

**Average** 313 **Total Average** 313

Pressure Drop - Inches of Water Column

Furnace Stacks Line #2

**Baseline Testing - Stack 3**

**Minimum  
Run 1**

**Tag** ADBI3715  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 4.348468304  
03-Oct-16 10:50:00 4.339649063  
  
03-Oct-16 12:42:00 4.197941597  
03-Oct-16 12:57:00 4.167322159  
03-Oct-16 13:12:00 4.18769825  
03-Oct-16 13:27:00 4.146478653  
03-Oct-16 13:42:00 4.173298359  
03-Oct-16 13:57:00 4.180965141

**Average** 4.2

**Minimum  
Run 2**

**Tag** ADBI3715  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 4.182210922  
03-Oct-16 15:20:00 4.220909338  
03-Oct-16 15:35:00 4.217665195  
03-Oct-16 15:50:00 4.15476539  
03-Oct-16 16:05:00 4.123675823  
03-Oct-16 16:20:00 4.230366224  
03-Oct-16 16:35:00 4.208787859  
03-Oct-16 16:50:00 4.186715603

**Average** 4.2

**Minimum  
Run 3**

**Tag** ADBI3715  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 4.288515307  
04-Oct-16 08:01:00 4.233870029  
04-Oct-16 08:16:00 4.233892365  
04-Oct-16 08:31:00 4.326082411  
04-Oct-16 08:46:00 4.284428596  
04-Oct-16 09:01:00 4.224834919  
04-Oct-16 09:16:00 4.275368091  
04-Oct-16 09:31:00 4.302729735

**Average** 4.3 **Total Average** 4.2

**Maximum  
Run 1**

**Tag** ADBI3715  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 4.406402082  
03-Oct-16 10:50:00 4.378182411  
  
03-Oct-16 12:42:00 4.242746431  
03-Oct-16 12:57:00 4.277578354  
03-Oct-16 13:12:00 4.264533669  
03-Oct-16 13:27:00 4.229551536  
03-Oct-16 13:42:00 4.363775253  
03-Oct-16 13:57:00 4.216524613

**Average** 4.3

**Maximum  
Run 2**

**Tag** ADBI3715  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 4.221519942  
03-Oct-16 15:20:00 4.234862328  
03-Oct-16 15:35:00 4.327476501  
03-Oct-16 15:50:00 4.292294014  
03-Oct-16 16:05:00 4.249736309  
03-Oct-16 16:20:00 4.248355524  
03-Oct-16 16:35:00 4.230366224  
03-Oct-16 16:50:00 4.246359067

**Average** 4.3

**Maximum  
Run 3**

**Tag** ADBI3715  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 4.351074219  
04-Oct-16 08:01:00 4.350546254  
04-Oct-16 08:16:00 4.340504839  
04-Oct-16 08:31:00 4.342772007  
04-Oct-16 08:46:00 4.326082411  
04-Oct-16 09:01:00 4.288720074  
04-Oct-16 09:16:00 4.371875763  
04-Oct-16 09:31:00 4.330577374

**Average** 4.3 **Total Average** 4.3

**Average  
Run 1**

**Tag** ADBI3715  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 4.370253797  
03-Oct-16 10:50:00 4.362758872  
  
03-Oct-16 12:42:00 4.22476736  
03-Oct-16 12:57:00 4.230604789  
03-Oct-16 13:12:00 4.237214635  
03-Oct-16 13:27:00 4.18136863  
03-Oct-16 13:42:00 4.262294842  
03-Oct-16 13:57:00 4.200547045

**Average** 4.3

**Average  
Run 2**

**Tag** ADBI3715  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 4.202981548  
03-Oct-16 15:20:00 4.228005835  
03-Oct-16 15:35:00 4.273664766  
03-Oct-16 15:50:00 4.242990227  
03-Oct-16 16:05:00 4.184493173  
03-Oct-16 16:20:00 4.238668701  
03-Oct-16 16:35:00 4.220734337  
03-Oct-16 16:50:00 4.208713799

**Average** 4.2

**Average  
Run 3**

**Tag** ADBI3715  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 4.324906218  
04-Oct-16 08:01:00 4.326663709  
04-Oct-16 08:16:00 4.265410857  
04-Oct-16 08:31:00 4.340767629  
04-Oct-16 08:46:00 4.302025558  
04-Oct-16 09:01:00 4.253883276  
04-Oct-16 09:16:00 4.323718849  
04-Oct-16 09:31:00 4.311036084

**Average** 4.3 **Total Average** 4.3

Furnace Stacks Line #2**Baseline Testing - Stack 3****Minimum  
Run 1**

**Tag** ADBI3717  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 346.5288086  
 03-Oct-16 10:50:00 348.8534241  
  
 03-Oct-16 12:42:00 342.7140503  
 03-Oct-16 12:57:00 344.9752228  
 03-Oct-16 13:12:00 348.3662388  
 03-Oct-16 13:27:00 348.4868614  
 03-Oct-16 13:42:00 340.7172852  
 03-Oct-16 13:57:00 342.3862305

**Average** 345

**Minimum  
Run 2**

**Tag** ADBI3717  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 350.9024282  
 03-Oct-16 15:20:00 346.3374714  
 03-Oct-16 15:35:00 342.7438354  
 03-Oct-16 15:50:00 343.8036968  
 03-Oct-16 16:05:00 344.9678839  
 03-Oct-16 16:20:00 341.4027405  
 03-Oct-16 16:35:00 349.4196777  
 03-Oct-16 16:50:00 351.1289066

**Average** 346

**Minimum  
Run 3**

**Tag** ADBI3717  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 345.9029236  
 04-Oct-16 08:01:00 350.084792  
 04-Oct-16 08:16:00 347.8997498  
 04-Oct-16 08:31:00 348.8228067  
 04-Oct-16 08:46:00 344.2041931  
 04-Oct-16 09:01:00 348.5437777  
 04-Oct-16 09:16:00 343.5187378  
 04-Oct-16 09:31:00 343.3101196

**Average** 347 **Total Average** 346

**Maximum  
Run 1**

**Tag** ADBI3717  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 354.9811681  
 03-Oct-16 10:50:00 360.8043518  
  
 03-Oct-16 12:42:00 348.4266823  
 03-Oct-16 12:57:00 348.3662388  
 03-Oct-16 13:12:00 360.744751  
 03-Oct-16 13:27:00 360.2380981  
 03-Oct-16 13:42:00 350.9396362  
 03-Oct-16 13:57:00 354.217926

**Average** 355

**Maximum  
Run 2**

**Tag** ADBI3717  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 352.6086121  
 03-Oct-16 15:20:00 351.8634949  
 03-Oct-16 15:35:00 349.3898621  
 03-Oct-16 15:50:00 351.3866577  
 03-Oct-16 16:05:00 358.2711182  
 03-Oct-16 16:20:00 353.6206515  
 03-Oct-16 16:35:00 354.4563293  
 03-Oct-16 16:50:00 357.5856628

**Average** 354

**Maximum  
Run 3**

**Tag** ADBI3717  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 354.1881104  
 04-Oct-16 08:01:00 354.186863  
 04-Oct-16 08:16:00 350.084792  
 04-Oct-16 08:31:00 353.9253943  
 04-Oct-16 08:46:00 354.1285095  
 04-Oct-16 09:01:00 362.0858459  
 04-Oct-16 09:16:00 352.1019287  
 04-Oct-16 09:31:00 355.201416

**Average** 354 **Total Average** 354

**Average****Run 1**

**Tag** ADBI3717  
**Start** 10/3/2016 10:35  
**End** 10/3/2016 11:08

03-Oct-16 10:35:00 348.8873937  
 03-Oct-16 10:50:00 352.4856561  
  
 03-Oct-16 12:42:00 344.7395674  
 03-Oct-16 12:57:00 346.994523  
 03-Oct-16 13:12:00 355.5477654  
 03-Oct-16 13:27:00 353.9075759  
 03-Oct-16 13:42:00 345.9034585  
 03-Oct-16 13:57:00 349.1340303

**Average** 350

**Average****Run 2**

**Tag** ADBI3717  
**Start** 10/3/2016 12:42  
**End** 10/3/2016 14:15

03-Oct-16 15:05:00 351.7783586  
 03-Oct-16 15:20:00 350.2065555  
 03-Oct-16 15:35:00 346.6318536  
 03-Oct-16 15:50:00 348.8221589  
 03-Oct-16 16:05:00 351.79959  
 03-Oct-16 16:20:00 349.7774885  
 03-Oct-16 16:35:00 352.3442859  
 03-Oct-16 16:50:00 355.7779471

**Average** 351

**Average****Run 3**

**Tag** ADBI3717  
**Start** 10/4/2016 7:46  
**End** 10/4/2016 9:53

04-Oct-16 07:46:00 349.536089  
 04-Oct-16 08:01:00 353.4589933  
 04-Oct-16 08:16:00 348.7540906  
 04-Oct-16 08:31:00 351.5290668  
 04-Oct-16 08:46:00 350.795212  
 04-Oct-16 09:01:00 353.9595179  
 04-Oct-16 09:16:00 347.6073189  
 04-Oct-16 09:31:00 349.2604905

**Average** 351 **Total Average** 349

Pressure Drop - Inches of Water Column

Furnace Stacks Line #2

**Baseline Testing - Stack 4**

**Minimum  
Run 1**

**Tag** ADBI3718  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	3.945198059
04-Oct-16 10:38:00	4.004627228
04-Oct-16 10:53:00	3.995933294
04-Oct-16 11:08:00	3.96816349
04-Oct-16 11:23:00	3.955435991
04-Oct-16 11:38:00	3.989777538
04-Oct-16 11:53:00	3.920898914
04-Oct-16 12:08:00	4.008442235

**Average** 3.973559594

**Maximum  
Run 1**

**Tag** ADBI3718  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	4.070866585
04-Oct-16 10:38:00	4.108344078
04-Oct-16 10:53:00	4.097225666
04-Oct-16 11:08:00	4.095781326
04-Oct-16 11:23:00	4.08715787
04-Oct-16 11:38:00	4.209328651
04-Oct-16 11:53:00	4.113605175
04-Oct-16 12:08:00	4.145230293

**Average** 4.115942456

**Average**

**Run 1**

**Tag** ADBI3718  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00	3.945198059
04-Oct-16 10:38:00	4.004627228
04-Oct-16 10:53:00	3.995933294
04-Oct-16 11:08:00	3.96816349
04-Oct-16 11:23:00	3.955435991
04-Oct-16 11:38:00	3.989777538
04-Oct-16 11:53:00	3.920898914
04-Oct-16 12:08:00	4.008442235

**Average** 3.973559594

**Minimum  
Run 2**

**Tag** ADBI3718  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	3.942931331
04-Oct-16 13:11:00	3.928116322
04-Oct-16 13:26:00	3.980484247
04-Oct-16 13:41:00	3.913311958
04-Oct-16 13:56:00	3.910357952
04-Oct-16 14:11:00	3.989581309
04-Oct-16 14:26:00	3.92278862
04-Oct-16 14:41:00	3.935293913

**Average** 3.9

**Maximum  
Run 2**

**Tag** ADBI3718  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	4.019326687
04-Oct-16 13:11:00	4.095319748
04-Oct-16 13:26:00	4.082927615
04-Oct-16 13:41:00	4.093549252
04-Oct-16 13:56:00	4.079978466
04-Oct-16 14:11:00	4.079556465
04-Oct-16 14:26:00	4.061858654
04-Oct-16 14:41:00	4.035485744

**Average** 4.1

**Average**

**Run 2**

**Tag** ADBI3718  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00	3.98821012
04-Oct-16 13:11:00	4.0055662
04-Oct-16 13:26:00	4.004411361
04-Oct-16 13:41:00	3.973302453
04-Oct-16 13:56:00	3.977181909
04-Oct-16 14:11:00	4.047014424
04-Oct-16 14:26:00	3.997311382
04-Oct-16 14:41:00	3.978640194

**Average** 4.0

**Minimum  
Run 3**

**Tag** ADBI3718  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	4.02481277
05-Oct-16 08:00:00	3.917826891
05-Oct-16 08:15:00	3.892709732
05-Oct-16 08:30:00	3.909476995
05-Oct-16 08:45:00	3.930171967
05-Oct-16 09:00:00	3.944386482
05-Oct-16 09:15:00	4.010637924
05-Oct-16 09:30:00	3.945310354

**Average** 3.9 **Total Average** 4.0

**Maximum  
Run 3**

**Tag** ADBI3718  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	4.102890491
05-Oct-16 08:00:00	4.02481277
05-Oct-16 08:15:00	3.982181319
05-Oct-16 08:30:00	4.041667099
05-Oct-16 08:45:00	4.0502491
05-Oct-16 09:00:00	4.037687144
05-Oct-16 09:15:00	4.118459702
05-Oct-16 09:30:00	4.040894989

**Average** 4.0 **Total Average** 4.1

**Average**

**Run 3**

**Tag** ADBI3718  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00	4.059726982
05-Oct-16 08:00:00	3.980033282
05-Oct-16 08:15:00	3.924352837
05-Oct-16 08:30:00	3.976081208
05-Oct-16 08:45:00	3.99163165
05-Oct-16 09:00:00	3.993978575
05-Oct-16 09:15:00	4.077678989
05-Oct-16 09:30:00	3.989239117

**Average** 4.0 **Total Average** 4.0

Furnace Stacks Line #2**Baseline Testing - Stack 4****Minimum  
Run 1**

**Tag** ADBI3720  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00 596.4846802  
 04-Oct-16 10:38:00 594.6965332  
 04-Oct-16 10:53:00 591.1500244  
 04-Oct-16 11:08:00 591.1798096  
 04-Oct-16 11:23:00 593.057373  
 04-Oct-16 11:38:00 594.130249  
 04-Oct-16 11:53:00 592.8360165  
 04-Oct-16 12:08:00 591.0307617

**Average** 593.070681

**Maximum  
Run 1**

**Tag** ADBI3720  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00 606.6474609  
 04-Oct-16 10:38:00 606.4984131  
 04-Oct-16 10:53:00 611.0284424  
 04-Oct-16 11:08:00 603.4013974  
 04-Oct-16 11:23:00 604.7698364  
 04-Oct-16 11:38:00 605.1572876  
 04-Oct-16 11:53:00 605.1292769  
 04-Oct-16 12:08:00 594.6664516

**Average** 604.6623208

**Average  
Run 1**

**Tag** ADBI3720  
**Start** 10/4/2016 10:23  
**End** 10/4/2016 12:28

04-Oct-16 10:23:00 600.4542362  
 04-Oct-16 10:38:00 600.8108847  
 04-Oct-16 10:53:00 600.6731826  
 04-Oct-16 11:08:00 594.9767982  
 04-Oct-16 11:23:00 597.2274208  
 04-Oct-16 11:38:00 597.200516  
 04-Oct-16 11:53:00 601.2111267  
 04-Oct-16 12:08:00 591.8995804

**Average** 598.0567182

**Minimum  
Run 2**

**Tag** ADBI3720  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00 597.8931185  
 04-Oct-16 13:11:00 595.0839233  
 04-Oct-16 13:26:00 595.9482422  
 04-Oct-16 13:41:00 592.1334839  
 04-Oct-16 13:56:00 594.3687134  
 04-Oct-16 14:11:00 595.1137695  
 04-Oct-16 14:26:00 596.6641004  
 04-Oct-16 14:41:00 588.8551636

**Average** 595

**Maximum  
Run 2**

**Tag** ADBI3720  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00 599.2453178  
 04-Oct-16 13:11:00 602.4154663  
 04-Oct-16 13:26:00 610.6708374  
 04-Oct-16 13:41:00 605.8435488  
 04-Oct-16 13:56:00 601.4319458  
 04-Oct-16 14:11:00 603.2797241  
 04-Oct-16 14:26:00 605.6937866  
 04-Oct-16 14:41:00 596.6641004

**Average** 603

**Average  
Run 2**

**Tag** ADBI3720  
**Start** 10/4/2016 12:56  
**End** 10/4/2016 15:03

04-Oct-16 12:56:00 598.2858221  
 04-Oct-16 13:11:00 598.6183479  
 04-Oct-16 13:26:00 600.3980383  
 04-Oct-16 13:41:00 597.3429156  
 04-Oct-16 13:56:00 597.2567066  
 04-Oct-16 14:11:00 598.9953517  
 04-Oct-16 14:26:00 603.111632  
 04-Oct-16 14:41:00 593.7152493

**Average** 598

**Minimum  
Run 3**

**Tag** ADBI3720  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00 592.5805664  
 05-Oct-16 08:00:00 587.9611206  
 05-Oct-16 08:15:00 595.024353  
 05-Oct-16 08:30:00 595.1383994  
 05-Oct-16 08:45:00 595.3223877  
 05-Oct-16 09:00:00 599.4053955  
 05-Oct-16 09:15:00 595.4117432  
 05-Oct-16 09:30:00 586.232605

**Average** 593 **Total Average** 594

**Maximum  
Run 3**

**Tag** ADBI3720  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00 601.6532846  
 05-Oct-16 08:00:00 601.6703491  
 05-Oct-16 08:15:00 603.8459473  
 05-Oct-16 08:30:00 597.1999512  
 05-Oct-16 08:45:00 603.9830108  
 05-Oct-16 09:00:00 606.3792114  
 05-Oct-16 09:15:00 604.1880947  
 05-Oct-16 09:30:00 597.0310501

**Average** 602 **Total Average** 603

**Average  
Run 3**

**Tag** ADBI3720  
**Start** 10/5/2016 7:45  
**End** 10/5/2016 9:50

05-Oct-16 07:45:00 597.1373352  
 05-Oct-16 08:00:00 594.2776326  
 05-Oct-16 08:15:00 600.7914439  
 05-Oct-16 08:30:00 596.0856425  
 05-Oct-16 08:45:00 598.403221  
 05-Oct-16 09:00:00 603.5413734  
 05-Oct-16 09:15:00 598.5226849  
 05-Oct-16 09:30:00 592.4118074

**Average** 598 **Total Average** 596

## **Appendix F**

### **Project Participants**

## Project Participants

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### **Hibbing Taconite Company**

Jack Croswell – General Manager

Julie Lucas – Area Manager-Environmental

Daniel Aagenes – Section Manager Plant Technical Services

Tasha Niemi – Environmental Representative-Plants

Corie Ekholm – CEMS Engineer

### **Barr Engineering Company**

Tim Russell – Vice President/Chemical Engineer

Tom Kuchinski – Stack Testing Services Coordinator

Tom Leier – Project Manager/Senior Air Quality Technician

Dan Koschak – Senior Air Quality Technician

Richard Berg – Senior Air Quality Technician

David Herbst – Air Quality Technician

John Rooney – Air Quality Technician

Mike Norstrem – Air Quality Engineer