APPENDIX

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Wheelabrator North Broward, Inc.
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REPORT ON MERCURY TESTING

Performed for:
WHEELABRATOR NORTH BROWARD, INC.
UNIT 3 FF OUTLET
POMPANO BEACH, FL

Client Reference No: Service Agreement
CleanAir Project No: 12218-5
Revision 0: July 16, 2013

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the actual emissions during the test program. Clean Air Engineering operates in conformance with the requirements of ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies.

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REPORT ON MERCURY TESTING

DRAFT REPORT REVISION HISTORY

Revision:	Date	Pages	Comments
D0a	07/02/13	All	Draft version of original document.

FINAL REPORT REVISION HISTORY

Revision:	Date	Pages	Comments
0	07/16/13	All	Final version of original document.

CONTENTS

PROJECT OVERVIEW

INTRODUCTION

Wheelabrator North Broward, Inc. operates a refuse-to-energy facility, located in Pompano Beach, Florida. The facility's emission levels are regulated by the Florida Department of Environmental Protection (DEP). Wheelabrator North Broward contracted Clean Air Engineering (CleanAir) to perform a compliance test program at its municipal waste combustor (MWC) facility in Pompano Beach, Florida. Testing was conducted in accordance with 40 CFR 60, Subpart Cb, and applicable sections of PSD-FL-112(B) and PA86-22. The sampling was conducted at the Unit 3 Fabric Filter (FF) Outlet on June 4 and 5, 2013.

All testing was conducted in accordance with the regulations set-forth by the United States Environmental Protection Agency (US EPA) and the DEP.

Key Project Participants

Individuals responsible for coordinating and conducting the test program were:

C. Faller – Wheelabrator North Broward, Inc.
R. Vicere – CleanAir

Test Program Parameters

The testing included the following emissions measurements:

- flue gas composition (e.g., O_2, CO_2, H_2O)
- flue gas flow rate
- flue gas temperature
- mercury (Hg)

Chuck Faller of Wheelabrator North Broward provided all the process (operating) data. This data is presented in its entirety in Appendix H.

The CleanAir test crew consisted of Paul Bihun, and all equipment utilized for testing was manufactured by CleanAir.

TEST PROGRAM SYNOPSIS

Test Schedule

The on-site schedule followed during the test program is outlined in Table 1-1.

Table 1-1:
Schedule of Activities

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	Unit 3 FF Outlet	USEPA Method 29	Mercury	06/04/13	11:51	14:03
2	Unit 3 FF Outlet	USEPA Method 29	Mercury	06/05/13	07:32	09:44
3	Unit 3 FF Outlet	USEPA Method 29	Mercury	06/05/13	10:02	12:13
4	Unit 3 FF Outlet	USEPA Method 29	Mercury	06/05/13	12:30	14:42

Results Summary

Table 1-2 summarizes the results of the test program. A more detailed presentation of the test conditions and results of analysis are shown in Tables 2-1 and 2-2 on pages 2-1 and 2-2.

Table 1-2:
Summary of Test Results

Source Constituent	Sampling Method	Average Emission	Permit Limit[1]
Unit 3 FF Outlet			
Mercury (µg/dscm @7% O_2)	EPA M29	6.6	50

[1] Limit obtained from the facility's Title V Permit No. 0112120-010-AV and Subpart Cb as of April 28, 2009.

During the compliance testing, Unit 3 was operated within 10% of the 186,000 lb/hr maximum steam flow rating. The Unit 3 boiler and air pollution control equipment are in a well-maintained operating condition. Normal operating parameters for the fabric filters are a pressure drop of 2 to 7 inches of water and scrubber dilution water flow varies from 0 to 40 gallons per minute (gpm). The equipment operated within these ranges during compliance testing. Table 2-1 on page 2-1 presents the boiler's steam output for every test run.

Four Method 29 test runs for mercury were performed at the Unit 3 FF Outlet, and all four runs were averaged to determine compliance with the permit limit.

End of Section 1 – Project Overview

RESULTS

Table 2-1:
Unit 3 FF Outlet – Mercury

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Process Conditions						
R_P	Production rate - (units/hour)	183.7	178.4	176.9	177.1	**179.0**
P_1	Process data - (units)	292	290	290	290	**290**
Gas Conditions						
O_2	Oxygen (dry volume %)	9.1	9.2	9.4	9.1	**9.2**
CO_2	Carbon dioxide (dry volume %)	9.8	10.1	9.4	9.7	**9.8**
T_s	Sample temperature (°F)	285	286	285	286	**285**
B_w	Actual water vapor in gas (% by volume)	26.4	26.9	25.6	25.0	**26.0**
Gas Flow Rate						
Q_a	Volumetric flow rate, actual (acfm)	189,000	183,000	173,000	173,000	**180,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	96,800	92,700	88,800	89,900	**92,000**
Sampling Data						
V_{mstd}	Volume metered, standard (dscf)	79.23	74.41	69.17	70.53	**73.34**
%I	Isokinetic sampling (%)	101.7	99.8	96.8	97.4	**98.9**
Laboratory Data						
m_{n-1b}	Fraction 1B (µg)	<0.1000	<0.1000	<0.1000	<0.1000	
m_{n-2b}	Fraction 2B (µg)	13.1804	10.4849	10.1246	12.4097	
m_{n-3a}	Fraction 3A (µg)	<0.2000	<0.2000	<0.2000	<0.2000	
m_{n-3b}	Fraction 3B (µg)	<0.5000	<0.5000	<0.5000	<0.5000	
m_{n-3c}	Fraction 3C (µg)	<0.4000	<0.4000	<0.4000	<0.4000	
m_n	Total matter corrected for allowable blanks (µg)	13.1804	10.4849	10.1246	12.4097	
Mercury Results - Total						
C_{sd}	Concentration (µg/dscm)	5.9	5.0	5.2	6.2	**5.6**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	6.9	5.9	6.2	7.3	**6.6**
$E_{lb/hr}$	Rate (lb/hr)	2.1E-03	1.7E-03	1.7E-03	2.1E-03	**1.9E-03**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	6.2E-06	5.3E-06	5.6E-06	6.6E-06	**5.9E-06**

RESULTS

Table 2-2:
Quality Assurance and Quality Control

Run Number		FH Front Half	BH H_2O_2/HNO_4	A Empty Impinger	B $KMnO_4$	C HCl
			RPD RESULTS			
Unit 3 R1		NA	0.3%	NA	NA	NA
Unit 3 R2		NA	1.8%	NA	NA	NA
Unit 3 R3		NA	0.0%	NA	NA	NA
Unit 3 R4		NA	1.5%	NA	NA	NA
Field Blank		NA	NA	NA	NA	NA
Reagent Blank		NA	NA	NA	NA	NA
			Sample Spike and Recovery			
Unit 3 R3	**#1**	104%	87%	93%	91%	107%
	#2	104%	86%	92%	92%	107%
			Blanks			
Field Blank	**#1**	< 0.1	< 0.3	< 0.2	< 0.5	< 0.4
	#2	< 0.1	< 0.3	< 0.2	< 0.5	< 0.4
Reagent Blank	**#1**	< 0.1	< 0.2	< 0.2	< 0.5	< 0.4
	#2	< 0.1	< 0.2	< 0.2	< 0.5	< 0.4

End of Section 2 – Results

METHODOLOGY

Clean Air Engineering followed procedures as detailed in US EPA Methods 1, 2, 3, 3B, 4 and 29. The following table summarizes the methods and their respective sources.

Table 4-1:
Summary of Sampling Procedures

Title 40 CFR Part 60 Appendix A	
Method 1	"Sample and Velocity Traverses for Stationary Sources"
Method 2	"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
Method 3	"Gas Analysis for the Determination of Dry Molecular Weight"
Method 3B	"Gas Analysis for the Determination of Emission Rate Correction Factor or Excess Air"
Method 4	"Determination of Moisture Content in Stack Gases"
Method 29	"Determination of Metals Emissions from Stationary Sources"

These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR) and are located on the internet at http://ecfr.gpoaccess.gov.

Diagrams of the sampling apparatus and major specifications of the sampling, recovery and analytical procedures are summarized for each method in Appendix A.

CleanAir followed specific quality assurance and quality control (QA/QC) procedures as outlined in the individual methods and as prescribed in CleanAir's internal Quality Manual. Results of all QA/QC activities performed by CleanAir are summarized in Appendix D.

End of Section 4 – Methodology

TEST METHOD SPECIFICATIONS

A

I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

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Specification Sheet for EPA Method 29

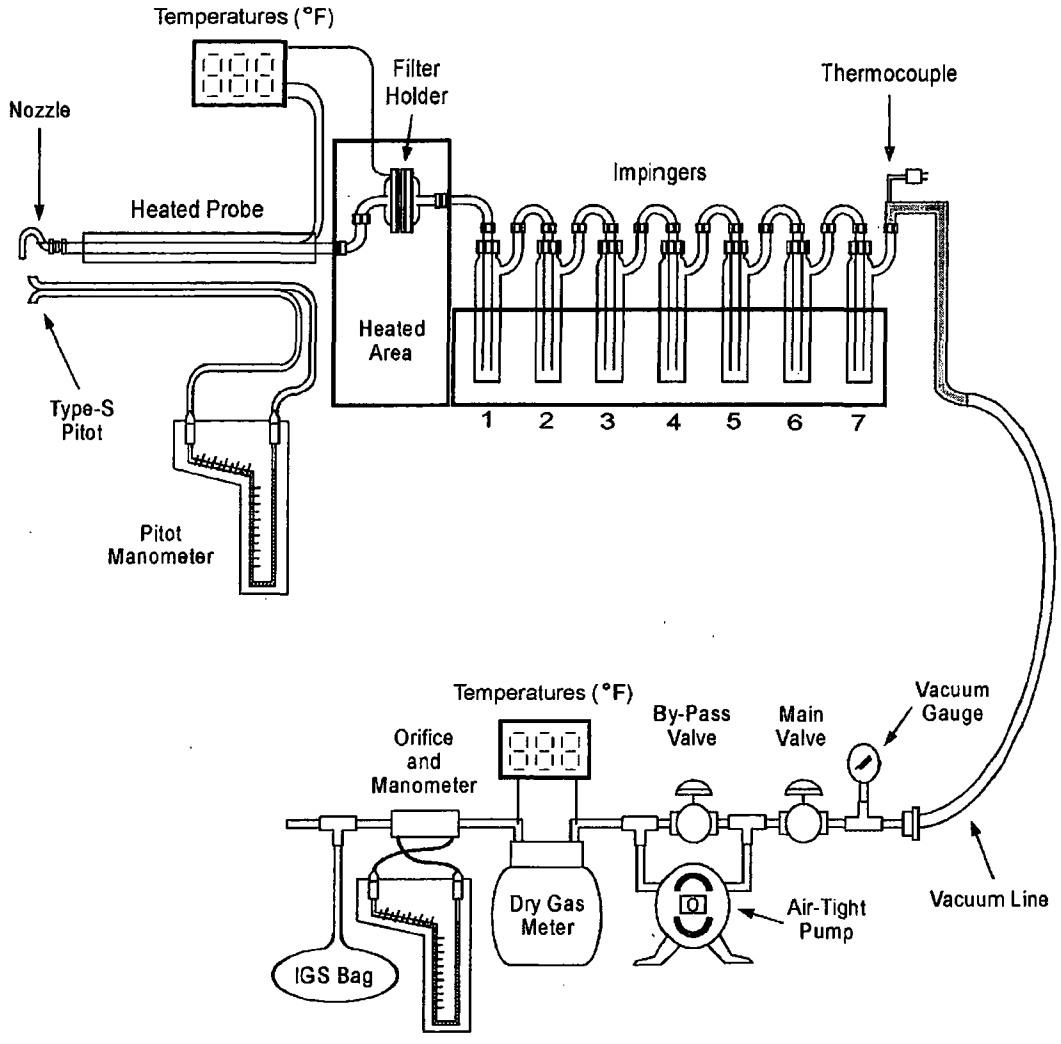
Source Location Name(s)	Unit 3 FF Outlet
Pollutant(s) to be Determined	Mercury
Other Parameters to be Determined from Train	Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	125 minutes
No. of Sample Traverse Points	N/A	25
Sample Time per Point	N/A	5 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	8 feet
Probe Temperature Set-Point	248°F±25°F	248°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.814
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass	Borosilicate Glass
Filter Support Material	Teflon (or other non-metallic)	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248°F±25°F	248°F±25°F
Filter Material	Quartz or Glass Fiber	Quartz Fiber
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for EPA Method 29

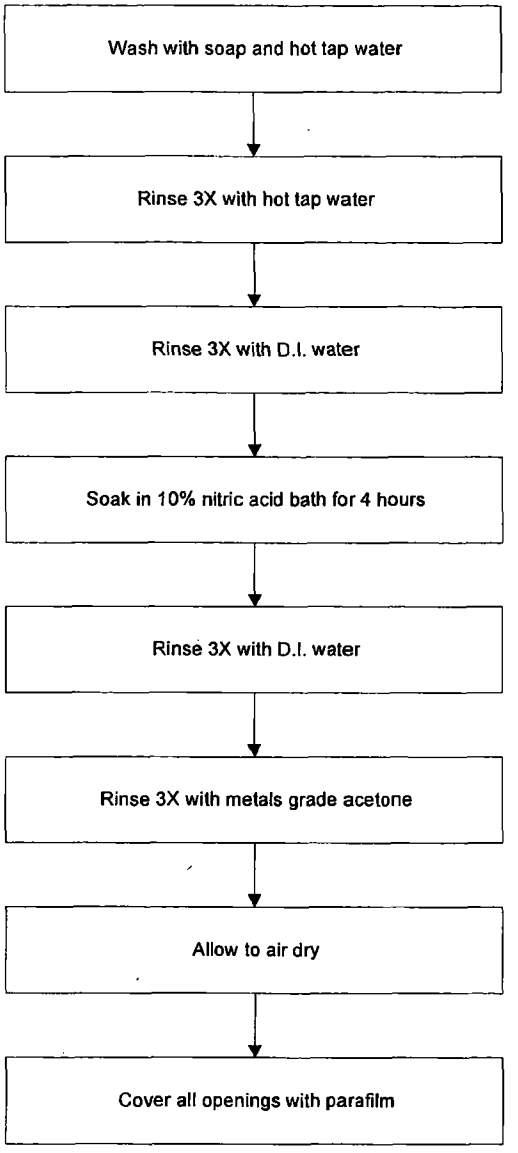
	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Ground Glass or Equivalent	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct Glass Connection	Direct Glass Connection
Number of Impingers	7	7
Impinger Stem Types		
Impinger 1	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 2	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 3	Greenburg-Smith	Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 6	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 7	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 8		
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or Fyrite Analyzer	Orsat
Sample Recovery Information		
Probe Brush Material	Non-metallic swab or bristle	Teflon Mat
Probe Rinse Reagent	0.1N Nitric Acid	0.1 N Nitric Acid
Probe Rinse Wash Bottle Material	Glass or Teflon	Teflon
Probe Rinse Storage Container	Polyethylene or glass	Polyethylene
Filter Recovered?	Yes	Yes
Filter Storage Container	Petri Dish - Glass or Polystyrene	Polyethylene
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	See Method 29 Recovery Flow Chart	See Recovery Flow Chart
Impinger Wash Bottle	Glass or Teflon	Teflon
Impinger Storage Container	See Recovery Flow Chart	See Recovery Flow Chart
Analytical Information		
Method 4 H_2O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	See Method 29 Analytical Flow Chart	For Metals Analysis
Front-Half Rinse Preparation	See Method 29 Analytical Flow Chart	See Analytical Flow Chart
Back-Half Analysis	See Method 29 Analytical Flow Chart	See Analytical Flow Chart
Additional Analysis	None	None

EPA Method 29
Sampling Train Configuration



Impinger Contents	
Impinger 1	Empty
Impinger 2	100 ml 5% HNO_3/10% H_2O_2
Impinger 3	100 ml 5% HNO_3/10% H_2O_2
Impinger 4	Empty
Impinger 5	100 ml 4% $KMnO_4$/10% H_2SO_4
Impinger 6	100 ml 4% $KMnO_4$/10% H_2SO_4
Impinger 7	Silica Gel

EPA Method 29
Glassware Preparation Procedures



EPA Method 29
Sample Recovery Flowchart
(includes Mercury)

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Collect one complete blank set per field test

Container 1
Tared Quartz Filter
Petri Dish

Remove with acid washed polypropylene or Teflon tweezers to plastic container.

Remove any particulate or filter fiber to sample container

If necessary, fold the filter and transfer to the container.

Container 3
Probe Rinse
250 ml Polyethylene

Probe liner, nozzle, cyclone bypass and front half (FH) filter housing

Brush/rinse 3X with a total of 100 ml 0.1N HNO3

Visual Inspection

Label container and measure volume by weight

Container 4
1000 ml Polyethylene

Back half (BH) filter housing, Z-piece, impingers 1, 2, 3 and U-bends

Measure impinger volume by weight

Transfer to sample container

Rinse each piece 3X with a total of 100 ml 0.1N HNO3

Visual Inspection

Label container and measure volume by weight

Container 5A
250 ml Polyethylene

Impinger 4 and U-bend

Measure impinger volume by weight to within 0.5 ml

Transfer to sample container

Rinse with 100 ml of 0.1N HNO3

Visual Inspection

Label container and measure volume by weight

Container 5B
950 ml Glass

Impingers 5, 6 and U-bends

Measure impinger volume by weight

Transfer to sample container

Rinse each piece 3X with 100 ml of acidic permanganate solution

Rinse 3X with 100 ml of water

Visual Inspection

Label container and measure volume by weight

Container 6
Silica Gel

Measure and record impinger, volume by weight, record condition of indicating gel

Recycle silica gel

Container 5C
250 ml Glass

If brown spots remain in impingers, remove residue with 25 ml of 8N HCl total for both impingers

Pour HCl rinse into bottle containing 200 ml of water

Label container and measure volume by weight

Container 8A
Nitric Acid Blank
1000 ml Plastic

300 ml of 0.1N HNO3

Container 8B
Water Blank
250 ml Plastic

100 ml of water

Container 9
5%HNO3/10%H2O2 Blank
500 ml Plastic

200 ml of absorbing solution

Container 10*
Permanganate Blank
500 ml Glass

100 ml KMnO4 solution

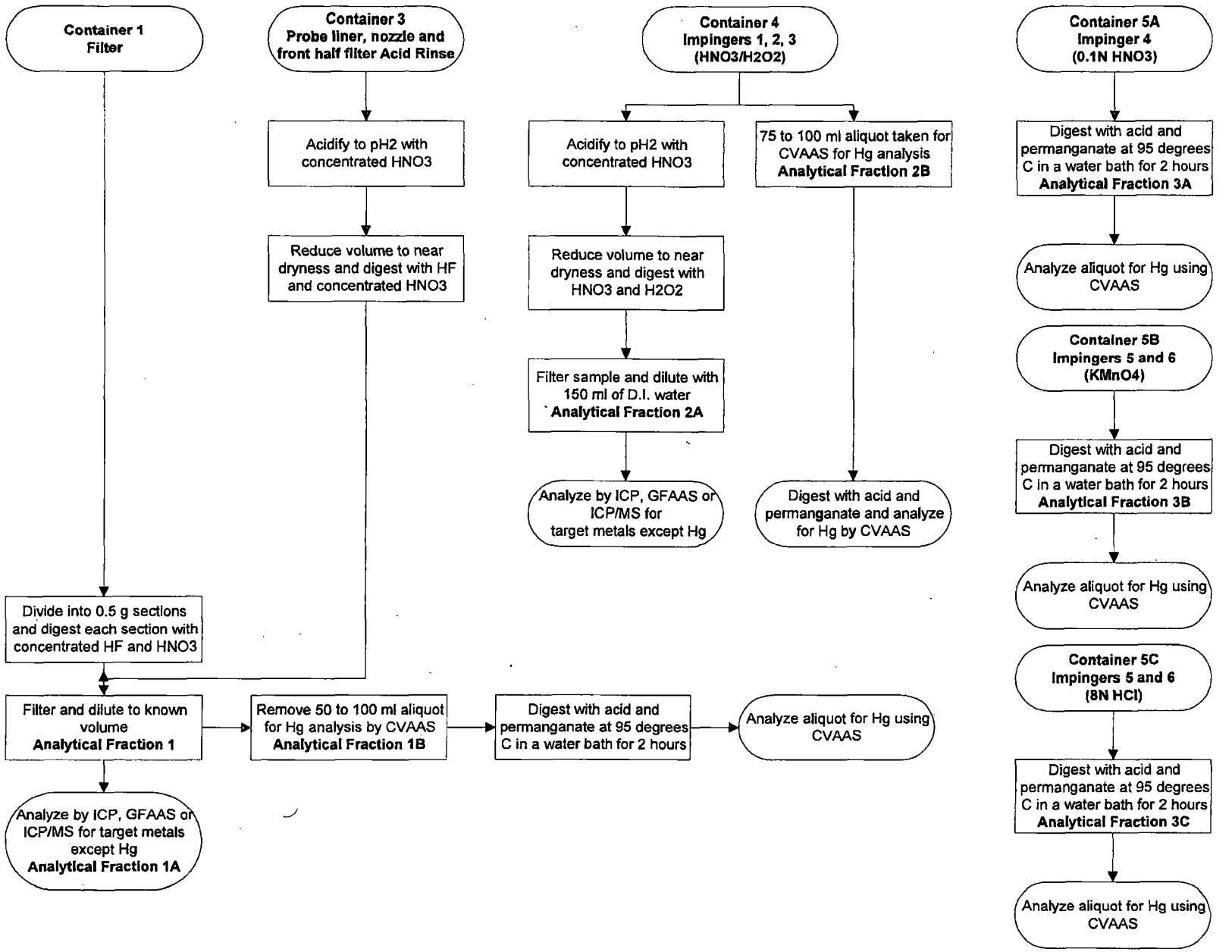
Container 11
HCl Rinse Blank
250 ml Glass

200 ml water, add 25 ml of 8N HCl. Mix well and seal

Container 12
Filter Blanks
Petri Dish

3 clean, unused filters

EPA Method 29
Analytical Flowchart
(includes Mercury)



SAMPLE CALCULATIONS

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QA/QC Initials: SB

Date: 7/16

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USEPA Method 29 (Trace Metals)
Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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K

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	602.8	ml
0.04706	= ideal gas conversion factor (ft^3 water vapor/ml or gm)	=	0.04706	ft^3/ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft^3)	=	28.37	ft^3

2. Volume of gas metered, standard conditions (dscf)

$$V_{mstd} = \frac{(17.64)(V_m)\left(P_{bar} + \frac{\Delta H}{13.6}\right)(Y_d)}{(460 + T_m)}$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	30.05	in. Hg
T_m	= average dry gas meter temperature (°F)	=	96.46	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	83.10	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9976	
ΔH	= average pressure drop across meter box orifice (in. H_2O)	=	1.35	in. H_2O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H_2O/in. Hg)	=	13.6	in.H_2O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	79.232	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6}\right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	30.05	in. Hg
P_g	= sample gas static pressure (in. H_2O)	=	-9.30	in. H_2O
13.6	= conversion factor (in. H_2O/in. Hg)	=	13.6	in. H_2O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}\right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	285.36	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	29.37	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	29.37	in. Hg

6. Moisture measured in sample (% by volume)

$$B_{wo} = \frac{V_{wstd}}{(V_{mstd} + V_{wstd})}$$

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	79.232	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	28.37	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2636	
		=	26.36	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	29.37	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions		1.0000	
		=	100.00	%

8. Actual water vapor in gas (% by volume)

$$B_w = MINIMUM \quad [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	1.0000	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2636	
B_w	= actual water vapor in gas	=	0.2636	
		=	26.36	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	9.8	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	9.1	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	81.07	%

10. Molecular weight of dry gas stream (lb/lb·mole)

$$M_d = (M_{CO_2})\frac{(CO_2)}{(100)} + (M_{O_2})\frac{(O_2)}{(100)} + (M_{N_2+CO})\frac{(N_2+CO)}{(100)}$$

Where:

M_{CO2}	= molecular weight of carbon dioxide (lb/lb·mole)	=	44.00	lb/lb·mole
M_{O2}	= molecular weight of oxygen (lb/lb·mole)	=	32.00	lb/lb·mole
M_{N2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb·mole)	=	28.00	lb/lb·mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	9.8	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	9.1	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	81.1	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb·mole)	=	29.93	lb/lb·mole

11. Molecular weight of sample gas (lb/lb·mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2636	
M_d	= dry molecular weight of sample gas (lb/lb·mole)	=	29.93	lb/lb·mole
M_{H2O}	= molecular weight of water (lb/lb·mole)	=	18.00	lb/lb·mole
M_s	= molecular weight of sample gas, wet basis (lb/lb·mole)	=	26.79	lb/lb·mole

12. Velocity of sample gas (ft/sec)

$$V_s = (K_p)(C_p)\left(\sqrt{\overline{\Delta P}}\right)\left(\sqrt{\frac{(\overline{T_s}+460)}{(M_s)(P_s)}}\right)$$

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.81	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb·mole)	=	26.79	lb/lb·mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
T_s	= average sample gas temperature (°F)	=	285.36	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H_2O)	=	0.727	$\sqrt{}$in. H_2O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	49.23	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

$$Q_a = (60)(A_s)(V_s)$$

Where:

A_s	= cross sectional area of sampling location (ft^2)	=	64.00	ft^2
V_s	= sample gas velocity (ft/sec)	=	49.23	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	189,031	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a)\left(\frac{P_s}{29.92}\right)\left(\frac{68+460}{T_s+460}\right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	189,031	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	285.4	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	131,428	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2636	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	131,428	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	96,778	dscfm

16. Dry flow of sample gas corrected to 7%O_2 (dscfm)

$$Q_{std\,7} = (Q_{std})\left(\frac{20.9 - O_2}{20.9 - 7}\right)$$

Where:

Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	96,778	dscfm
O_2	= proportion of oxygen in the gas stream by volume (%)	=	9.1	%
20.9	= oxygen content of ambient air (%)	=	20.9	%
7	= oxygen content of corrected gas (%)	=	7.0	%
Q_{std7}	= volumetric flow rate at STP and 7%O_2, dry basis (dscfm)	=	81,925	dscfm

17. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft^3/min)	=	96,778	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	5,806,676	dscf/hr

18. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english})\left(\frac{60}{35.31}\right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft^3/min)	=	96,778	dscfm
35.31	= conversion factor (ft^3/m^3)	=	35.31	ft^3/m^3
60	= conversion factor (min/hr)	=	60	min/hr
$Q_{std-metric}$	= volumetric flow rate, metric units (m^3/hr)	=	164,448	dry std m^3/hr

19. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric})\left(\frac{32 + 460}{68 + 460}\right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m^3/hr)	=	164,448	dry std m^3/hr
32	= normal temperature (°F)	=	32	°F
68	standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	
Q_{Normal}	= volumetric flow rate, metric units (dry Nm^3/hr)	=	153,236	dry Nm^3/hr

20. Percent isokinetic (%)

$$I = \frac{(0.09450)(\overline{T_s} + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.275	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2636	
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
T_s	= average sample gas temperature (°F)	=	285.4	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	79.232	dscf
V_s	= sample gas velocity (ft/sec)	=	49.23	ft/sec
θ	= total sampling time (min)	=	125	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	101.69	%

21. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m}\sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_@)(P_{bar} + \frac{\Delta H}{13.6})(M_d)}}(\sqrt{\Delta H})_{avg}$$

Where:

θ	= total sampling time (min)	=	125	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	83.10	dcf
T_m	= average dry gas meter temperature (°F)	=	96.46	°F
$\Delta H_@$	= dry gas meter orifice coefficient	=	1.7594	
P_{bar}	= barometric pressure (in. Hg)	=	30.05	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H_2O)	=	1.352	in. H_2O
M_d	= dry molecular weight of sample gas (lb/lb·mole)	=	29.93	lb/lb·mole
$\sqrt{\Delta H_{avg}}$	= average of square root of pressure drop across meter orifice	=	1.161	√in. H_2O
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H_2O/in. Hg)	=	13.6	in.H_2O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	0.9940	

LOGIC FOR TREATING DETECTION LIMITS

(mercury only)

1. Logic for Determining Total Blank ($m_{Total-B}$) from 5 Fractions

	CASE 1 All 5 fractions are D.	CASE 2 1 to 4 fractions are ND	CASE 3 All 5 fractions are ND
Rule			
ND = 0	$m_{Total-B}$ = Sum D, 1-5	$m_{Total-B}$ = Sum D	$m_{Total-B}$ = < Sum ND
ND=1x	$m_{Total-B}$ = Sum D, 1-5	$m_{Total-B}$ = Sum D	$m_{Total-B}$ = < Sum ND
ND=0.5x	$m_{Total-B}$ = Sum D, 1-5	$m_{Total-B}$ = Sum D	$m_{Total-B}$ = < 0.5 Sum ND

2. Logic for Determining Total Sample ($m_{Total-S}$) from 5 Fractions

	CASE 1 All 5 fractions are D.	CASE 2 1 to 4 fractions are ND	CASE 3 All 5 fractions are ND
Rule			
ND = 0	$m_{Total-S}$ = Sum D, 1-5	$m_{Total-S}$ = Sum D	$m_{Total-S}$ = < Sum ND
ND=1x	$m_{Total-S}$ = Sum D, 1-5	$m_{Total-S}$ = < [Sum D + Sum ND]	$m_{Total-S}$ = < Sum ND
ND=0.5x	$m_{Total-S}$ = Sum D, 1-5	$m_{Total-S}$ = < [SumD+0.5 SumND]	$m_{Total-S}$ = < 0.5 Sum ND

3. Logic for Determining Maximum Allowable Blank Correction ($m_{T-B-allow}$)

	CASE 1 All 5 fractions are D. $m_{Total-B}$ = D	CASE 2 1 to 4 sample fractions are ND $m_{Total-B}$ = D	CASE 3 All 5 fractions are ND $m_{Total-B}$ = D	CASE 4 Any type of fractions $m_{Total-B}$ = ND
Rule				
ND = 0	$m_{T-B-allow}$ = M29 Rule	$m_{T-B-allow}$ = M29 Rule*	$m_{T-B-allow}$ = 0	$m_{T-B-allow}$ = 0
ND=1x	$m_{T-B-allow}$ = M29 Rule	$m_{T-B-allow}$ = M29 Rule*	$m_{T-B-allow}$ = 0	$m_{T-B-allow}$ = 0
ND=0.5x	$m_{T-B-allow}$ = M29 Rule	$m_{T-B-allow}$ = M29 Rule*	$m_{T-B-allow}$ = 0	$m_{T-B-allow}$ = 0

* M29 rule using only detected sample quantities for logical comparisons.

4. Logic for Determining Blank-Corrected Sample Amount (m_n)

	CASE 1 All 5 fractions are D. $m_{Total-S} - m_{T-B-allow} \geq$ MIN(MDL)	CASE 2 1 to 4 sample fractions are ND $m_{Total-S} - m_{T-B-allow} \geq$ MIN(MDL)	CASE 3 All 5 fractions are ND $m_{Total-S}$ and $m_{T-B-allow}$ anything	CASE 4 Any type of fractions $m_{Total-S} - m_{T-B-allow}$ < MIN(MDL)
Rule				
ND = 0	$m_n = m_{Total-S} - m_{T-B-allow}$	$m_n = m_{Total-S} - m_{T-B-allow}$	m_n = < $m_{Total-S}$	m_n = < MIN[MDL]
ND=1x	$m_n = m_{Total-S} - m_{T-B-allow}$	m_n = < [$m_{Total-S} - m_{T-B-allow}$]	m_n = < $m_{Total-S}$	m_n = < MIN[MDL]
ND=0.5x	$m_n = m_{Total-S} - m_{T-B-allow}$	m_n = < [$m_{Total-S} - m_{T-B-allow}$]	m_n = < $m_{Total-S}$	m_n = < MIN[MDL]

Definitions and Notes

The term "Rule" refers to the rule being implemented for handling non-detectable quantities in summations.
MDL = minimum detection limit.
D = Detectable quantity reported as D.
ND = Non-Detectable quantity reported at a value of ND.
MIN[MDL] = lowest quantity of all detection limits for 5 fractions.

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SS Metals-1 Version 2006-12c

USEPA Method 29 (Trace Metals)
Mercury Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

Note: Please see the preceding page concerning treatment of minimum detection limits and mathematical operations on values that are below minimum detection limits.

062513 101038
N

1. Total blank amount (µg)

$$m_{total-B} = \sum_{i=1}^{n} m_{i-B}$$

Where:

m_{1b-B}	= mercury amount in blank for Fraction 1b	=	<0.1000	µg
m_{2b-B}	= mercury amount in blank for Fraction 2b	=	<0.2000	µg
m_{3a-B}	= mercury amount in blank for Fraction 3a	=	<0.2000	µg
m_{3b-B}	= mercury amount in blank for Fraction 3b	=	<0.5000	µg
m_{3c-B}	= mercury amount in blank for Fraction 3c	=	<0.4000	µg
$m_{total-B}$	= total amount of mercury in blank	=	<1.4000	µg

2. Total sample amount (µg)

$$m_{total-S} = \sum_{i=1}^{n} m_{i-S}$$

Where:

m_{1b-S}	= mercury amount in sample for Fraction 1b	=	<0.1000	µg
m_{2b-S}	= mercury amount in sample for Fraction 2b	=	13.1804	µg
m_{3a-S}	= mercury amount in sample for Fraction 3a	=	<0.2000	µg
m_{3b-S}	= mercury amount in sample for Fraction 3b	=	<0.5000	µg
m_{3c-S}	= mercury amount in sample for Fraction 3c	=	<0.4000	µg
$m_{total-S}$	= total amount of mercury in sample	=	13.1804	µg

3. Allowable blank correction (µg)

$$m_{T-B-allow} = m_{total-B} \text{ if } m_{total-B} \leq 0.6$$

$$m_{T-B-allow} = MAX\left[0.6,\ MIN\left(m_{total-B},\ 0.05 \times m_{total-S}\right)\right] \text{ if } m_{total-B} > 0.6$$

Where:

$m_{total-B}$	= total amount of mercury in blank	=	<1.4000	µg
$m_{total-S}$	= total amount of mercury in sample	=	13.1804	µg
$0.05 \times m_{total-S}$	= 5% of $m_{total-S}$	=	0.6590	µg
MAX	= arithmetic operator that returns the maximum of two values			
MIN	= arithmetic operator that returns the minimum of two values			
$m_{T-B-allow}$	= total allowable blank correction	=	0.0000	µg

NOTE: In this case, the second criteria applies.

4. Sample corrected for allowable blank - Total (µg)

$$m_n = m_{total-S} - m_{T-B-allow}$$

Where:

$m_{total-S}$	= total amount of mercury in sample	=	13.1804	µg
$m_{T-B-allow}$	= total allowable blank correction	=	0.0000	µg
m_n	= total mercury in sample corrected for allowable blank	=	13.1804	µg

5. Sample corrected for allowable blank - Prorated for each fraction (µg)

$$m_{n-i} = \left(\frac{m_{i-S}}{m_{total-S}}\right)(m_n)$$

Where:

m_n	= total mercury in sample corrected for allowable blank	=	13.1804	µg
m_{1b-S}	= mercury amount in sample for Fraction 1b	=	<0.1000	µg
m_{2b-S}	= mercury amount in sample for Fraction 2b	=	13.1804	µg
m_{3a-S}	= mercury amount in sample for Fraction 3a	=	<0.2000	µg
m_{3b-S}	= mercury amount in sample for Fraction 3b	=	<0.5000	µg
m_{3c-S}	= mercury amount in sample for Fraction 3c	=	<0.4000	µg
$m_{total-S}$	= total amount of mercury in sample	=	13.1804	µg
m_{n-1b}	= mercury corrected for blank - prorated for Fraction 1b	=	<0.1000	µg
m_{n-2b}	= mercury corrected for blank - prorated for Fraction 2b	=	13.1804	µg
m_{n-3a}	= mercury corrected for blank - prorated for Fraction 3a	=	<0.2000	µg
m_{n-3b}	= mercury corrected for blank - prorated for Fraction 3b	=	<0.5000	µg
m_{n-3c}	= mercury corrected for blank - prorated for Fraction 3c	=	<0.4000	µg

USEPA Method 29 (Trace Metals)
Mercury Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

082513 101133
K_N

1. Mercury concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205\times10^{-3}}{10^{6}}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
C_{sd}	= mercury concentration (lb/dscf)	=	3.6681E-10	lb/dscf

2. Mercury concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}}\right)(35.31)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= mercury concentration (µg/dscm)	=	5.8739E+00	µg/dscm

3. Mercury concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{35.31}{1000}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
1000	= conversion factor (µg/mg)	=	1000	µg/mg
C_{sd}	= mercury concentration (mg/dscm)	=	5.8739E-03	mg/dscm

4. Mercury concentration (µg/Nm3 dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}}\right)(35.31)\left(\frac{68 + 460}{32 + 460}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= mercury concentration (µg/Nm3 dry)	=	6.3037E+00	µg/Nm^3 dry

5. Mercury concentration corrected to x% oxygen (lb/dscf example)

$$C_{sdx} = C_{sd}\left(\frac{20.9 - x}{20.9 - O_2}\right)$$

Where:

C_{sd}	= mercury concentration (lb/dscf)	=	3.6681E-10	lb/dscf
x	= oxygen content of corrected gas (%)	=	7.0	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	9.1	%
20.9	= oxygen content of ambient air (%)	=	20.9	%
C_{sdx}	= mercury concentration corrected to x% oxygen (lb/dscf)	=	4.3331E-10	lb/dscf @ x%O_2

6. Mercury concentration corrected to y% carbon dioxide (lb/dscf example)

$$C_{sdy} = C_{sd}\left(\frac{y}{CO_2}\right)$$

Where:

C_{sd}	= mercury concentration (lb/dscf)	=	3.6681E-10	lb/dscf
y	= carbon dioxide content of corrected gas (%)	=	12.0	%
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	9.8	%
C_{sdy}	= mercury conc. corrected to y% carbon dioxide (lb/dscf)	=	4.4915E-10	lb/dscf @ y%CO_2

7. Mercury concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd}\left(\frac{Q_{std}}{Q_a}\right)$$

Where:

C_{sd}	= mercury concentration (lb/dscf)	=	3.6681E-10	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	96,778	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	189,031	acfm
C_a	= mercury concentration at actual gas conditions (lb/acf)	=	1.8779E-10	lb/acf

8. Mercury emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205 \times 10^{-3}}{10^6}\right)(Q_{std})(60)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	96,778	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= mercury emission rate (lb/hr)	=	2.1299E-03	lb/hr

9. Mercury emission rate (g/s)

$$E_{g/s} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{Q_{std}}{(10^6)(60)}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	96,778	dscfm
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
60	= conversion factor (sec/min)	=	60	sec/min
$E_{g/s}$	= mercury emission rate (g/s)	=	2.6832E-04	g/s

10. Mercury emission rate (Ton/yr)

$$E_{T/yr} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205 \times 10^{-3}}{10^6}\right)(Q_{std})(60)\left(\frac{Cap}{2000}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	96,778	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
Cap	= capacity factor for process (hours operated/year)	=	8,760	hours/yr
2000	= conversion factor (lb/Ton)	=	2000	lb/Ton
$E_{T/yr}$	= mercury emission rate (Ton/yr)	=	9.3291E-03	Ton/yr

PARAMETERS

C

I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

CleanAir

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Sampling, Velocity and Moisture Parameters

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Sampling Conditions						
Y_d	Dry gas meter correction factor	0.9976	0.9976	0.9976	0.9976	
C_p	Pitot tube coefficient	0.8140	0.8140	0.8140	0.8140	
P_g	Static pressure (in. H_2O)	-9.3000	-9.8000	-10.0000	-9.9000	
A_s	Sample location area (ft^2)	64.0000	64.0000	64.0000	64.0000	
P_{bar}	Barometric pressure (in. Hg)	30.05	29.95	29.95	29.95	**29.9750**
D_n	Nozzle diameter (in.)	0.2750	0.2750	0.2750	0.2750	
O_2	Oxygen (dry volume %)	9.1333	9.2333	9.4000	9.1333	**9.2250**
CO_2	Carbon dioxide (dry volume %)	9.8000	10.1333	9.4000	9.6667	**9.7500**
N_2+CO	Nitrogen plus carbon monoxide (dry volume %)	81.0667	80.6333	81.2000	81.2000	**81.0250**
V_{lc}	Total Liquid collected (ml)	602.80	580.90	506.90	500.50	
V_m	Volume metered, meter conditions (ft^3)	83.1000	78.0500	72.9750	74.7500	
T_m	Dry gas meter temperature (°F)	96.4600	94.4200	97.5000	100.1000	
T_s	Sample temperature (°F)	285.3600	285.5600	285.1600	285.5200	**285.4000**
ΔH	Meter box orifice pressure drop (in. H_2O)	1.3520	1.1916	1.0644	1.1064	
θ	Total sampling time (min)	125.0	125.0	125.0	125.0	
Flow Results						
V_{wstd}	Volume of water collected (ft^3)	28.3678	27.3372	23.8547	23.5535	**25.7783**
V_{mstd}	Volume metered, standard (dscf)	79.2321	74.4140	69.1695	70.5303	**73.3364**
P_s	Sample gas pressure, absolute (in. Hg)	29.3662	29.2294	29.2147	29.2221	**29.2581**
P_v	Vapor pressure, actual (in. Hg)	29.3662	29.2294	29.2147	29.2221	**29.2581**
B_{wo}	Moisture measured in sample (% by volume)	26.3641	26.8667	25.6436	25.0346	**25.9773**
B_{ws}	Saturated moisture content (% by volume)	100.0000	100.0000	100.0000	100.0000	**100.0000**
B_w	Actual water vapor in gas (% by volume)	26.3641	26.8667	25.6436	25.0346	**25.9773**
$\sqrt{\Delta P}$	Velocity head ($\sqrt{}$in. H_2O)	0.7267	0.7020	0.6625	0.6665	**0.6894**
M_d	MW of sample gas, dry (lb/lb-mole)	29.9333	29.9907	29.8800	29.9120	**29.9290**
M_s	MW of sample gas, wet (lb/lb-mole)	26.7872	26.7692	26.8335	26.9299	**26.8300**
V_s	Velocity of sample (ft/sec)	49.2269	47.6882	44.9447	45.1470	**46.7517**
%I	Isokinetic sampling (%)	101.6851	99.7516	96.7597	97.4458	**98.9105**
Q_a	Volumetric flow rate, actual (acfm)	189,031	183,123	172,588	173,365	**179,527**
Q_s	Volumetric flow rate, standard (scfm)	131,428	126,693	119,408	119,918	**124,362**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	96,778	92,655	88,788	89,897	**92,029**
Q_{std7}	Volumetric flow rate, dry std@7%O_2 (dscfm)	81,925	77,768	73,457	76,100	**77,312**
Q_a	Volumetric flow rate, actual (acf/hr)	11,341,868	10,987,361	10,355,256	10,401,879	**10,771,591**
Q_s	Volumetric flow rate, standard (scf/hr)	7,885,663	7,601,569	7,164,488	7,195,080	**7,461,700**
Q_{std}	Volumetric flow rate, dry standard (dscf/hr)	5,806,676	5,559,279	5,327,258	5,393,819	**5,521,758**
Q_a	Volumetric flow rate, actual (m^3/hr)	321,208	311,169	293,267	294,587	**305,058**
Q_s	Volumetric flow rate, standard (m^3/hr)	223,327	215,281	202,903	203,769	**211,320**
Q_{std}	Volumetric flow rate, dry standard (dry m^3/hr)	164,448	157,442	150,871	152,756	**156,379**
Q_{std7}	Volumetric flow rate, dry std@7%O_2 (dry m^3/hr)	139,209	132,146	124,821	129,312	**131,372**
Q_s	Volumetric flow rate, normal (Nm^3/hr)	208,100	200,603	189,068	189,876	**196,912**
Q_{std}	Volumetric flow rate, dry normal (Nm^3/hr)	153,236	146,707	140,584	142,341	**145,717**
Q_{std7}	Volumetric flow rate, dry normal @7%O_2 (Nm^3/hr)	129,718	123,136	116,311	120,495	**122,415**

Comments:

Average includes 4 runs.

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Mercury (Hg) Emission Parameters

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Process Conditions						
R_P	Steam Production Rate - (klbs/hour)	183.7	178.4	176.9	177.1	**179.0**
P_t	Fabric Filter Inlet Temperature - (°F)	292	290	290	290	**290**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,570	9,570	9,570	9,570	**9,570**
F_c	Carbon dioxide-based F-factor (dscf/MMBtu)	1,820	1,820	1,820	1,820	**1,820**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760	**8,760**
Gas Conditions						
O_2	Oxygen (dry volume %)	9.1333	9.2333	9.4000	9.1333	**9.2250**
CO_2	Carbon dioxide (dry volume %)	9.8000	10.1333	9.4000	9.6667	**9.7500**
T_s	Sample temperature (°F)	285.3600	285.5600	285.1600	285.5200	**285.4000**
B_w	Actual water vapor in gas (% by volume)	26.3641	26.8667	25.6436	25.0346	**25.9773**
Gas Flow Rate						
Q_a	Volumetric flow rate, actual (acfm)	189,031	183,123	172,588	173,365	**179,527**
Q_s	Volumetric flow rate, standard (scfm)	131,428	126,693	119,408	119,918	**124,362**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	96,778	92,655	88,788	89,897	**92,029**
Sampling Data						
V_{mstd}	Volume metered, standard (dscf)	79.2321	74.4140	69.1695	70.5303	**73.3364**
%I	Isokinetic sampling (%)	101.6851	99.7516	96.7597	97.4458	**98.9105**
Laboratory Data						
$m_{n\text{-}1b}$	Fraction 1B (µg)	<0.1000	<0.1000	<0.1000	<0.1000	
$m_{n\text{-}2b}$	Fraction 2B (µg)	13.1804	10.4849	10.1246	12.4097	
$m_{n\text{-}3a}$	Fraction 3A (µg)	<0.2000	<0.2000	<0.2000	<0.2000	
$m_{n\text{-}3b}$	Fraction 3B (µg)	<0.5000	<0.5000	<0.5000	<0.5000	
$m_{n\text{-}3c}$	Fraction 3C (µg)	<0.4000	<0.4000	<0.4000	<0.4000	
m_n	Total matter corrected for allowable blanks (µg)	13.1804	10.4849	10.1246	12.4097	
Mercury Results - Total						
C_{sd}	Concentration (lb/dscf)	3.6681E-10	3.1068E-10	3.2275E-10	3.8797E-10	**3.4705E-10**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	4.3331E-10	3.7016E-10	3.9011E-10	4.5831E-10	**4.1297E-10**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	4.4915E-10	3.6792E-10	4.1203E-10	4.8161E-10	**4.2768E-10**
C_a	Concentration (lb/acf)	1.8779E-10	1.5720E-10	1.6604E-10	2.0118E-10	**1.7805E-10**
C_{sd}	Concentration (µg/dscm)	5.8739E+00	4.9752E+00	5.1684E+00	6.2127E+00	**5.5576E+00**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	6.9388E+00	5.9276E+00	6.2471E+00	7.3391E+00	**6.6132E+00**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	7.1925E+00	5.8916E+00	6.5980E+00	7.7124E+00	**6.8486E+00**
C_{sd}	Concentration (mg/dscm)	5.8739E-03	4.9752E-03	5.1684E-03	6.2127E-03	**5.5576E-03**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	6.9388E-03	5.9276E-03	6.2471E-03	7.3391E-03	**6.6132E-03**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	7.1925E-03	5.8916E-03	6.5980E-03	7.7124E-03	**6.8486E-03**
C_a	Concentration (µg/m^3 (actual,wet))	3.0072E+00	2.5173E+00	2.6589E+00	3.2216E+00	**2.8513E+00**
C_{sd}	Concentration (µg/Nm^3 dry)	6.3037E+00	5.3392E+00	5.5466E+00	6.6673E+00	**5.9642E+00**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	7.4466E+00	6.3613E+00	6.7042E+00	7.8761E+00	**7.0970E+00**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	7.7188E+00	6.3227E+00	7.0808E+00	8.2767E+00	**7.3498E+00**
$E_{lb/hr}$	Rate (lb/hr)	2.1299E-03	1.7272E-03	1.7194E-03	2.0926E-03	**1.9173E-03**
$E_{g/s}$	Rate (g/s)	2.6832E-04	2.1758E-04	2.1660E-04	2.6362E-04	**2.4153E-04**
$E_{T/yr}$	Rate (Ton/yr)	9.3291E-03	7.5650E-03	7.5309E-03	9.1657E-03	**8.3977E-03**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	6.2351E-06	5.3264E-06	5.6135E-06	6.5948E-06	**5.9424E-06**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	6.8121E-06	5.5800E-06	6.2491E-06	7.3045E-06	**6.4864E-06**

Prepared by Clean Air Engineering Proprietary Software
SS Metals-1 Version 2006-12c

Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Mercury (Hg) Emission Parameters (continued)
Separate Front Half Results

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Mercury Results - Front Half						
C_{sd}	Concentration (lb/dscf)	<2.7830E-12	<2.9632E-12	<3.1878E-12	<3.1263E-12	**<3.0151E-12**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	<3.2875E-12	<3.5304E-12	<3.8531E-12	<3.6931E-12	**<3.5910E-12**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	<3.4077E-12	<3.5090E-12	<4.0696E-12	<3.8809E-12	**<3.7168E-12**
C_a	Concentration (lb/acf)	<1.4248E-12	<1.4993E-12	<1.6400E-12	<1.6211E-12	**<1.5463E-12**
C_{sd}	Concentration (µg/dscm)	<4.4565E-02	<4.7451E-02	<5.1049E-02	<5.0064E-02	**<4.8282E-02**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	<5.2645E-02	<5.6534E-02	<6.1702E-02	<5.9140E-02	**<5.7505E-02**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	<5.4570E-02	<5.6192E-02	<6.5168E-02	<6.2148E-02	**<5.9519E-02**
C_{sd}	Concentration (mg/dscm)	<4.4565E-05	<4.7451E-05	<5.1049E-05	<5.0064E-05	**<4.8282E-05**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	<5.2645E-05	<5.6534E-05	<6.1702E-05	<5.9140E-05	**<5.7505E-05**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	<5.4570E-05	<5.6192E-05	<6.5168E-05	<6.2148E-05	**<5.9519E-05**
C_a	Concentration (µg/m^3 (actual,wet))	<2.2816E-02	<2.4009E-02	<2.6262E-02	<2.5960E-02	**<2.4762E-02**
C_{sd}	Concentration (µg/Nm^3 dry)	<4.7826E-02	<5.0923E-02	<5.4784E-02	<5.3727E-02	**<5.1815E-02**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	<5.6497E-02	<6.0671E-02	<6.6217E-02	<6.3468E-02	**<6.1713E-02**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	<5.8563E-02	<6.0303E-02	<6.9937E-02	<6.6695E-02	**<6.3875E-02**
$E_{lb/hr}$	Rate (lb/hr)	<1.6160E-05	<1.6473E-05	<1.6982E-05	<1.6863E-05	**<1.6619E-05**
$E_{g/s}$	Rate (g/s)	<2.0357E-06	<2.0752E-06	<2.1394E-06	<2.1243E-06	**<2.0937E-06**
$E_{T/yr}$	Rate (Ton/yr)	<7.0780E-05	<7.2152E-05	<7.4383E-05	<7.3859E-05	**<7.2793E-05**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	<4.7306E-08	<5.0800E-08	<5.5444E-08	<5.3142E-08	**<5.1673E-08**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	<5.1684E-08	<5.3220E-08	<6.1722E-08	<5.8861E-08	**<5.6372E-08**

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Mercury (Hg) Emission Parameters (continued)
Separate Impinger 1-3 Results

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Mercury Results - Impingers 1-3 Solution						
C_{sd}	Concentration (lb/dscf)	3.6681E-10	3.1068E-10	3.2275E-10	3.8797E-10	**3.4705E-10**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	4.3331E-10	3.7016E-10	3.9011E-10	4.5831E-10	**4.1297E-10**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	4.4915E-10	3.6792E-10	4.1203E-10	4.8161E-10	**4.2768E-10**
C_a	Concentration (lb/acf)	1.8779E-10	1.5720E-10	1.6604E-10	2.0118E-10	**1.7805E-10**
C_{sd}	Concentration (µg/dscm)	5.8739E+00	4.9752E+00	5.1684E+00	6.2127E+00	**5.5576E+00**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	6.9388E+00	5.9276E+00	6.2471E+00	7.3391E+00	**6.6132E+00**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	7.1925E+00	5.8916E+00	6.5980E+00	7.7124E+00	**6.8486E+00**
C_{sd}	Concentration (mg/dscm)	5.8739E-03	4.9752E-03	5.1684E-03	6.2127E-03	**5.5576E-03**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	6.9388E-03	5.9276E-03	6.2471E-03	7.3391E-03	**6.6132E-03**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	7.1925E-03	5.8916E-03	6.5980E-03	7.7124E-03	**6.8486E-03**
C_a	Concentration (µg/m^3 (actual,wet))	3.0072E+00	2.5173E+00	2.6589E+00	3.2216E+00	**2.8513E+00**
C_{sd}	Concentration (µg/Nm^3 dry)	6.3037E+00	5.3392E+00	5.5466E+00	6.6673E+00	**5.9642E+00**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	7.4466E+00	6.3613E+00	6.7042E+00	7.8761E+00	**7.0970E+00**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	7.7188E+00	6.3227E+00	7.0808E+00	8.2767E+00	**7.3498E+00**
$E_{lb/hr}$	Rate (lb/hr)	2.1299E-03	1.7272E-03	1.7194E-03	2.0926E-03	**1.9173E-03**
$E_{g/s}$	Rate (g/s)	2.6832E-04	2.1758E-04	2.1660E-04	2.6362E-04	**2.4153E-04**
$E_{T/yr}$	Rate (Ton/yr)	9.3291E-03	7.5650E-03	7.5309E-03	9.1657E-03	**8.3977E-03**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	6.2351E-06	5.3264E-06	5.6135E-06	6.5948E-06	**5.9424E-06**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	6.8121E-06	5.5800E-06	6.2491E-06	7.3045E-06	**6.4864E-06**

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Mercury (Hg) Emission Parameters (continued)
Separate Impinger 4 Results

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Mercury Results - Impinger 4 Solution						
C_{sd}	Concentration (lb/dscf)	<5.5659E-12	<5.9263E-12	<6.3756E-12	<6.2526E-12	**<6.0301E-12**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	<6.5750E-12	<7.0608E-12	<7.7062E-12	<7.3863E-12	**<7.1821E-12**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	<6.8154E-12	<7.0180E-12	<8.1391E-12	<7.7619E-12	**<7.4336E-12**
C_a	Concentration (lb/acf)	<2.8496E-12	<2.9985E-12	<3.2799E-12	<3.2423E-12	**<3.0926E-12**
C_{sd}	Concentration (µg/dscm)	<8.9131E-02	<9.4902E-02	<1.0210E-01	<1.0013E-01	**<9.6564E-02**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	<1.0529E-01	<1.1307E-01	<1.2340E-01	<1.1828E-01	**<1.1501E-01**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	<1.0914E-01	<1.1238E-01	<1.3034E-01	<1.2430E-01	**<1.1904E-01**
C_{sd}	Concentration (mg/dscm)	<8.9131E-05	<9.4902E-05	<1.0210E-04	<1.0013E-04	**<9.6564E-05**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	<1.0529E-04	<1.1307E-04	<1.2340E-04	<1.1828E-04	**<1.1501E-04**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	<1.0914E-04	<1.1238E-04	<1.3034E-04	<1.2430E-04	**<1.1904E-04**
C_a	Concentration (µg/m^3 (actual,wet))	<4.5632E-02	<4.8017E-02	<5.2524E-02	<5.1920E-02	**<4.9523E-02**
C_{sd}	Concentration (µg/Nm^3 dry)	<9.5652E-02	<1.0185E-01	<1.0957E-01	<1.0745E-01	**<1.0363E-01**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	<1.1299E-01	<1.2134E-01	<1.3243E-01	<1.2694E-01	**<1.2343E-01**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	<1.1713E-01	<1.2061E-01	<1.3987E-01	<1.3339E-01	**<1.2775E-01**
$E_{lb/hr}$	Rate (lb/hr)	<3.2320E-05	<3.2946E-05	<3.3965E-05	<3.3726E-05	**<3.3239E-05**
$E_{g/s}$	Rate (g/s)	<4.0715E-06	<4.1504E-06	<4.2787E-06	<4.2486E-06	**<4.1873E-06**
$E_{T/yr}$	Rate (Ton/yr)	<1.4156E-04	<1.4430E-04	<1.4877E-04	<1.4772E-04	**<1.4559E-04**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	<9.4611E-08	<1.0160E-07	<1.1089E-07	<1.0628E-07	**<1.0335E-07**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	<1.0337E-07	<1.0644E-07	<1.2344E-07	<1.1772E-07	**<1.1274E-07**

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Mercury (Hg) Emission Parameters (continued)
Separate Impinger 5-6 Results

Run No.		1	2	3	4	Average
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Mercury Results - Filtered Permanganate Solution						
C_{sd}	Concentration (lb/dscf)	<1.3915E-11	<1.4816E-11	<1.5939E-11	<1.5632E-11	**<1.5075E-11**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	<1.6438E-11	<1.7652E-11	<1.9266E-11	<1.8466E-11	**<1.7955E-11**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	<1.7039E-11	<1.7545E-11	<2.0348E-11	<1.9405E-11	**<1.8584E-11**
C_a	Concentration (lb/acf)	<7.1239E-12	<7.4963E-12	<8.1999E-12	<8.1056E-12	**<7.7315E-12**
C_{sd}	Concentration (µg/dscm)	<2.2283E-01	<2.3725E-01	<2.5524E-01	<2.5032E-01	**<2.4141E-01**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	<2.6323E-01	<2.8267E-01	<3.0851E-01	<2.9570E-01	**<2.8753E-01**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	<2.7285E-01	<2.8096E-01	<3.2584E-01	<3.1074E-01	**<2.9760E-01**
C_{sd}	Concentration (mg/dscm)	<2.2283E-04	<2.3725E-04	<2.5524E-04	<2.5032E-04	**<2.4141E-04**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	<2.6323E-04	<2.8267E-04	<3.0851E-04	<2.9570E-04	**<2.8753E-04**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	<2.7285E-04	<2.8096E-04	<3.2584E-04	<3.1074E-04	**<2.9760E-04**
C_a	Concentration (µg/m^3 (actual,wet))	<1.1408E-01	<1.2004E-01	<1.3131E-01	<1.2980E-01	**<1.2381E-01**
C_{sd}	Concentration (µg/Nm^3 dry)	<2.3913E-01	<2.5461E-01	<2.7392E-01	<2.6863E-01	**<2.5907E-01**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	<2.8249E-01	<3.0335E-01	<3.3108E-01	<3.1734E-01	**<3.0857E-01**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	<2.9281E-01	<3.0152E-01	<3.4968E-01	<3.3348E-01	**<3.1937E-01**
$E_{lb/hr}$	Rate (lb/hr)	<8.0799E-05	<8.2365E-05	<8.4912E-05	<8.4314E-05	**<8.3097E-05**
$E_{g/s}$	Rate (g/s)	<1.0179E-05	<1.0376E-05	<1.0697E-05	<1.0622E-05	**<1.0468E-05**
$E_{T/yr}$	Rate (Ton/yr)	<3.5390E-04	<3.6076E-04	<3.7191E-04	<3.6930E-04	**<3.6397E-04**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	<2.3653E-07	<2.5400E-07	<2.7722E-07	<2.6571E-07	**<2.5836E-07**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	<2.5842E-07	<2.6610E-07	<3.0861E-07	<2.9431E-07	**<2.8186E-07**
Mercury Results - HCl Rinse + HCl/MnO2 Precipitate						
C_{sd}	Concentration (lb/dscf)	<1.1132E-11	<1.1853E-11	<1.2751E-11	<1.2505E-11	**<1.2060E-11**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	<1.3150E-11	<1.4122E-11	<1.5412E-11	<1.4773E-11	**<1.4364E-11**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	<1.3631E-11	<1.4036E-11	<1.6278E-11	<1.5524E-11	**<1.4867E-11**
C_a	Concentration (lb/acf)	<5.6992E-12	<5.9971E-12	<6.5599E-12	<6.4845E-12	**<6.1852E-12**
C_{sd}	Concentration (µg/dscm)	<1.7826E-01	<1.8980E-01	<2.0419E-01	<2.0025E-01	**<1.9313E-01**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	<2.1058E-01	<2.2614E-01	<2.4681E-01	<2.3656E-01	**<2.3002E-01**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	<2.1828E-01	<2.2477E-01	<2.6067E-01	<2.4859E-01	**<2.3808E-01**
C_{sd}	Concentration (mg/dscm)	<1.7826E-04	<1.8980E-04	<2.0419E-04	<2.0025E-04	**<1.9313E-04**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	<2.1058E-04	<2.2614E-04	<2.4681E-04	<2.3656E-04	**<2.3002E-04**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	<2.1828E-04	<2.2477E-04	<2.6067E-04	<2.4859E-04	**<2.3808E-04**
C_a	Concentration (µg/m^3 (actual,wet))	<9.1264E-02	<9.6035E-02	<1.0505E-01	<1.0384E-01	**<9.9047E-02**
C_{sd}	Concentration (µg/Nm^3 dry)	<1.9130E-01	<2.0369E-01	<2.1914E-01	<2.1491E-01	**<2.0726E-01**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	<2.2599E-01	<2.4268E-01	<2.6487E-01	<2.5387E-01	**<2.4685E-01**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	<2.3425E-01	<2.4121E-01	<2.7975E-01	<2.6678E-01	**<2.5550E-01**
$E_{lb/hr}$	Rate (lb/hr)	<6.4639E-05	<6.5892E-05	<6.7929E-05	<6.7451E-05	**<6.6478E-05**
$E_{g/s}$	Rate (g/s)	<8.1430E-06	<8.3008E-06	<8.5575E-06	<8.4972E-06	**<8.3746E-06**
$E_{T/yr}$	Rate (Ton/yr)	<2.8312E-04	<2.8861E-04	<2.9753E-04	<2.9544E-04	**<2.9117E-04**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	<1.8922E-07	<2.0320E-07	<2.2178E-07	<2.1257E-07	**<2.0669E-07**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	<2.0673E-07	<2.1288E-07	<2.4689E-07	<2.3544E-07	**<2.2549E-07**

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KMOK_N

QA/QC DATA

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I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

CleanAir.

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
QA/QC Results

Run No.		1	2	3	4	
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5	
Start Time (approx.)		11:51	07:32	10:02	12:30	
Stop Time (approx.)		14:03	09:44	12:13	14:42	
Total Duration of Test Run (min.)		132	132	131	132	
Net Sampling Time (min.)		125	125	125	125	
Sampling System Calibration Summary						
	Nozzle ID No:	275-1	275-1	275-1	275-1	
D_n	Nozzle Diameter (in):	0.275	0.275	0.275	0.275	
	Probe ID No:	66-8-1	66-8-1	66-8-1	66-8-1	
C_p	Pitot Coefficient:	0.8140	0.8140	0.8140	0.814	
	Meter Box ID. No:	66-13	66-13	66-13	66-13	
Y_d	Meter Box Yd - Field Sheet	0.9976	0.9976	0.9976	0.9976	
	Meter Box Yd - Database	0.9976	0.9976	0.9976	0.9976	
	Meter Box ΔH@ - Field Sheet	1.7594	1.7594	1.7594	1.7594	
	Meter Box ΔH@ - Database	1.7594	1.7594	1.7594	1.7594	
QA/QC						
	Final Leak Check					
	(a) 4% of Sampling Rate (cfm)	0.0266	0.0250	0.0234	0.0239	
	(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200	0.0200	
	Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200	0.0200	
	Actual Final Leak Rate (cfm)	0.0030	0.0040	0.0030	0.0030	
	Sample Volume					
	Minimum Volume Required (dscf)	30.00	30.00	30.00	30.00	
V_{mstd}	Actual Sample Volume (dscf)	79.232	74.414	69.169	70.530	
	Alternative Method 5 Post-Test Calibration (EPA ALT-009)					
$\sqrt{\Delta H_{avg}}$	Average of Square Root of ΔH (in. W.C.)	1.1614	1.0906	1.0298	1.0501	
Y_{qa}	Alternative Meter Calibration Factor	0.9940	0.9929	1.0075	1.0047	**Average**
	Variation from full-test Y_d (average ≤ ±5%)	-0.4%	-0.5%	1.0%	0.7%	**0.2%**
	Mean Isokinetic Sampling Rate Variation					
	Minimum Allowable (%)	90	90	90	90	
	Maximum Allowable (%)	110	110	110	110	
%I	Actual Variation (%)	101.69	99.75	96.76	97.45	
	Point-by-Point Isokinetic Variation					
	Number of points <90%	0	0	0	0	
	Number of points >110%	0	0	0	0	
	Number of points <80%	0	0	0	0	
	Number of points >120%	0	0	0	0	

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Nozzle Calibration Sheet

Client Wheelabrator	Project Number 12218
Calibrated by R. Vicere	Unit 3
Date 6/4/13	Runs 1-4

Caliper ID: 12089946

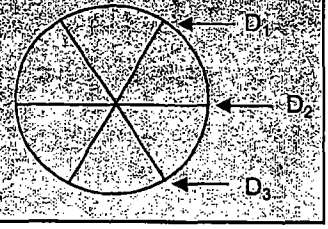
Nozzle Identification	D_1 (inches)	D_2 (inches)	D_3 (inches)	ΔD (inches)	D_{ave} (inches)
0.275-1	0.2750	0.2755	0.2750	0.0005	0.27516

D_1, D_2, D_3 = three nozzle diameter measurements

ΔD = maximum difference between any two diameters

$\Delta D \leq 0.004$ inches*

D_{ave} = average of D_1, D_2, D_3



* (40 CFR 60, Appendix A, Method 5, Section 5.1)

QA/QC RV
Date 6/4/13

CleanAir ENGINEERING

Caliper Calibration Sheet

Calibrated by	D.Leishman		
Calibration Date	May 9, 2013	Expiration Date	May 10, 2014

Caliper ID	12089946

Standard Caliper ID	101460021

Inside Jaw Check		
Standard Caliper Setting (in)	Caliper Reading (in)	Deviation (ΔD)
0.150	0.1495	0.0005
0.300	0.3000	0.0000
0.500	0.5005	0.0005

Outside Jaw Check		
Standard Caliper Setting (in)	Caliper Reading (in)	Deviation (ΔD)
0.150	0.1500	0.0000
0.300	0.3005	0.0005
0.500	0.5000	0.0000

ΔD = maximum deviation between standard and caliper being calibrated
ΔD ≤ 0.001 inch for every reading

QA/QC [signature]
Date 5/9/13

CleanAir ENGINEERING

new caliper cal sheet. August 2004

Clean Air Engineering - Meter Box Full Test Calibration

Client: Source | **Reviewed By:** R. REDEL | **Calibration Signature:**

ID No: 66-13 | **Calibrated By:** J. Ivens | **Meter Box Yd:** 0.9976

Dept No: 66 | **Date of Calibration:** 03/13/13 | **Meter Box ΔH@:** 1.7594

Meter Box Serial No: 66-13 | **Due Date of Calibration:** 03/14/13 | **Barometer Serial No:** W12637

Manufacturer Part No: 0028 | **Meter Box Vacuum:** 1.0 in. H_2O | **Barometric Pressure:** 29.36 in. Hg

				Standard Meter Gas Volume (ft^3)			Meter Box Gas Volume (ft^3)			Std. Meter Temperature (°F)			Meter Box Temperature (°F)			Time (min.)	Calibration Results	
Q	ΔH	ΔP	Y_{ds}	Initial	Final	V_{ds} Net	Initial	Final	V_d Net	T_{is} In	T_{os} Out	T_{ds} Avg.	T_i In	T_o Out	T_d Avg.	Θ	Y_d	ΔH@
0.394	0.50	-1.20	1.0000	0.000	5.000	5.000	107.600	112.701	5.101	65.0	65.0	65.00	80.0	77.0	78.50	12.52	1.0011	1.7483
0.394	0.50	-1.20	1.0000	0.000	5.000	5.000	112.701	117.802	5.101	65.0	65.0	65.00	81.0	78.0	79.50	12.51	1.0030	1.7423
0.684	1.50	-1.50	1.0000	0.000	10.000	10.000	127.800	138.065	10.265	65.5	65.5	65.50	85.0	79.0	82.00	14.41	0.9973	1.7338
0.684	1.50	-1.50	1.0000	0.000	10.000	10.000	138.065	148.342	10.277	65.5	65.5	65.50	85.0	79.0	82.00	14.40	0.9961	1.7314
0.955	3.00	-1.80	1.0000	0.000	10.000	10.000	76.700	86.884	10.184	65.0	65.0	65.00	83.0	72.0	77.50	10.33	0.9933	1.8020
0.954	3.00	-1.80	1.0000	0.000	10.000	10.000	86.884	97.093	10.209	65.0	65.0	65.00	85.0	74.0	79.50	10.34	0.9946	1.7988
																Averages	0.99756	1.75944

Nomenclature

P_b	Barometric Pressure (in. Hg)
Q	Flow Rate (cfm)
ΔH	Orifice Pressure differential (in. H_2O)
ΔP	Inlet Pressure Differential (in. H_2O)
V_d	Gas Meter Volume - Dry (ft^3)
V_{ds}	Standard Meter Volume - Dry (ft^3)
T_d	Average Meter Box Temperature (°F)
T_o	Outlet Meter Box Temperature (°F)
T_{ds}	Average Standard Meter Temperature (°F)
Y_d	Meter Correction Factor (unitless), $Y_i \leq Y_{avg} \pm 0.02$
Y_{ds}	Standard Meter Correction Factor (unitless)
ΔH@	Orifice Pressure Differential giving 0.75 cfm of air at 68 °F and 29.92 in. Hg (in. H_2O) $\Delta H@_i \leq \Delta H@_{avg} \pm 0.2$
Θ	Duration of Run (minutes)

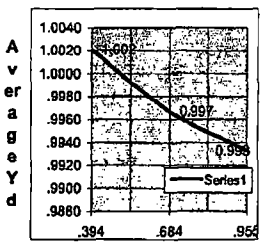
Equations

$$Y_d = (Y_{ds})\left[\frac{V_{ds}}{V_d}\right]\left[\frac{T_d + 460}{T_{ds} + 460}\right]\left[\frac{P_b + \Delta P/13.6}{P_b + \Delta H/13.6}\right]$$

$$\Delta H@ = \frac{(0.0319)(\Delta H)}{P_b(T_o + 460)}\left[\frac{(T_{ds} + 460)\Theta}{(V_{ds})(Y_{ds})}\right]^2$$

$$Q = \frac{17.64(V_{ds})(P_b)}{(T_{ds} + 460)(\Theta)}$$

Average YD vs. Average CFM



Vacuum Gauge	
Standard (in.Hg)	Gauge (in.Hg)
5.4	5.0
10.0	10.0
15.3	15.0
20.0	20.0
24.8	25.0

Calibration Reference Information (Standard Meter)

Reference Used: Wet Test Meter | Serial No: 11AG9

Calibrated By: Martin Vaquero | Date Calibrated: 7/22/2012

Percent Error: 0.245% | Calibration Due Date: 7/23/2013

Meter Box Pre-Calibration Inspection

Positive Leak Check:	Pass	Electrical Check:	Pass
Negative Leak Check:	Pass	Pyrometer Check	Pass
Vacuum Gauge Check:	Pass	YD Tolerance:	Pass

CleanAir ENGINEERING

Meter Box - Pyrometer Calibration Sheet

Meter Box No: 66-13 Office: n/a

Calibrated by: J. Ivens Client: n/a

Date: 3/13/13 Job No: n/a

Temperature Scale Used: Fahrenheit Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1 Stack	2 Probe	3 Filter	4 Imp Out	5 Aux	6	7
50	52	51	51	51	52		
100	102	101	101	102	102		
150	152	152	151	152	152		
200	202	202	201	202	202		
250	252	252	251	252	252		
300	302	302	301	302	302		
350	352	352	351	352	352		
400	402	402	401	402	402		
450	452	452	451	452	452		
500	502	502	500	502	502		
550	552	552	551	552	552		
600	602	602	600	602	602		

Tolerance = ±2°F difference from reference setting.

Calibration Reference Information

Reference Used: Omega CL23A Serial No: T-225950

Calibrated By: JH Metrology Date Calibrated: 10/18/2012

Calibration Report No: 1000164938 Calibration Due Date: 10/18/2013

Sample Probe Calibration

Probe Type: M5 with S-Type Pitot **I.D. Number:** 66-8-1
Project Number: Browards

Thermocouple Calibration

Reference Type: Thermocouple Reference I.D. No: 15-078-39 Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Specification
1	Ambient	69	69	0	0.00%	
2	200°F-250°F	248	249	-1	0.14%	%Difference ≤ 1.5

* Based on Absolute Temperature (Rankine)

Does thermocouple assembly meet specifications? ⟶ YES

Pitot Tube Calibration (Wind Tunnel Method @ 30 ft/sec)

Reference Pitot I.D. No: Wind Tunnel Reference Pitot Cp: 0.99

Pitot Side 'A' :

Trial No.	Reference ΔP	Probe ΔP	Probe $C_{p(S)}$*	Abs. Deviation from Avg. $C_{p(A)}$**	Specification
1	0.559	0.823	0.816	0.001	Avg. C_p Deviations ≤ 0.01
2	0.555	0.823	0.813	0.001	
3	0.555	0.820	0.815	0.000	
		Side 'A' Average Probe $C_{p(A)}$=	0.8145	0.0009	

Pitot Side 'B' :

Trial No.	Reference ΔP	Probe ΔP	Probe $C_{p(S)}$*	Abs. Deviation from Avg. $C_{p(B)}$**	Specification
1	0.557	0.821	0.815	0.002	Avg. C_p Deviations ≤ 0.01
2	0.555	0.822	0.814	0.001	
3	0.552	0.824	0.810	0.003	
		Side 'B' Average Probe $C_{p(B)}$=	0.8130	0.0019	

'A' Average C_p		'B' Average C_p		Difference	Specification
0.814	—	0.813	=	0.001	|Difference| ≤ 0.01

Does assembly meet specifications? YES ⟶ **If "Yes", C_p = Average of Side 'A' and 'B' Cp values. If "No", Pitot must be replaced.**

$$^{*}C_{P(S)} = C_{P(STD)}\sqrt{\frac{\Delta p_{(STD)}}{\Delta p_{(S)}}} \qquad ^{**}Deviation = \left|C_{P(S)} - \overline{C}_{P(\text{A or B})}\right|$$

All specifications are from EPA-600/9-76-005, Section 3.1

Probe Cp= 0.814 Calibrated by: S DOOLEY Date: 03/13/2013

CleanAir. ENGINEERING

METROLOGY

Certificate of Calibration

2033001736

ACCREDITED
Certificate #1618.01

Customer Information

On Site Calibration
CleanAir Engineering, Inc.
500 W. Wood Street
Palatine, IL 60067

PO #: 04380-64-65800
Reference #: 1232582dd
Account #: 09352MT
SO #: 32582

Instrument Identification

Instrument Id: **8028301068**
Location:
Noun: Scale, 4100/0.1 Gram Digital
Model: AV4101C
Mfr: Ohaus
Serial #: 8028301068
Accuracy: ±0.1 Gram repeatability, ±0.3 Linearity

Certification Information

Reason For Service: Calibration with Data
Type Of Calibration: Normal
As Found Condition: In Tolerance
As Left Condition: Left As Found
Procedure: 33K6-4-41-1 : Scales

Technician: Eric Uphouse
Cal Date: 16 AUG 12
Cal Due: 16 AUG 13
Temperature: 21.0 °C
Humidity: 35.0 %

✓In Tolerance ✗Out of Tolerance

Calibration Data

Range	Nominal	As Found		As Left		Min	Max
Plate Repeatability							
Center	5.0	5.0	✓	As Found		4.9	5.1
Left Rear	5.0	5.0	✓	As Found		4.9	5.1
Right Rear	5.0	5.0	✓	As Found		4.9	5.1

No sampling plan or other procedure was used for this calibration. Measurements and information on this certificate are valid at time of calibration only and any number of factors may cause calibration to drift out of tolerance prior to calibration due date.

This instrument has been calibrated using standards with accuracies traceable to the National Institute of Standards and Technology, derived from natural physical constants, from ratio measurements, or compared to consensus standards.

The expanded uncertainty of the measurement process has not exceeded 25% of the tolerance allowed for the individual characteristics measured, unless otherwise stated. The uncertainties are based on a 95% confidence level, K=2.

J.H. Metrology Co., Inc's Calibration Control System complies with applicable requirements of ANSI Z540-1-1994, ISO 9001, and ISO/IEC 17025-2005.

The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without the written approval of J.H. Metrology Co., Inc.

Approved by: Vice President

Date: Aug 19, 2012

Printed: 8/23/2012 13:08:36

METROLOGY

Certificate of Calibration

2033001736

ACCREDITED
Certificate #1618.01

✓In Tolerance ✗Out of Tolerance

Calibration Data

Range	Nominal	As Found		As Left		Min	Max
Plate Repeatability							
Left Front	5.0	5.0	✓	As Found		4.9	5.1
Right Front	5.0	5.0	✓	As Found		4.9	5.1
Center	5.0	5.0	✓	As Found		4.9	5.1
Linearity							
4100 Grams	100.0	100.0	✓	As Found		99.7	100.3
	2000.0	1999.9	✓	As Found		1999.7	2000.3
	4000.0	3999.8	✓	As Found		3999.7	4000.3

End of Datasheet

Calibration Standards

NIST Traceable #	Instrument ID#	Description	Model	Calibration Date	Date Due
1000150842	00941	Metric Weight Set, 12 Piece, Class 2	Unknown	03 NOV 2010	30 NOV 2012
1000152014	01088	Weight Set, 1mg - 200g, Class 1	Unknown	01 DEC 2010	31 DEC 2012

No sampling plan or other procedure was used for this calibration. Measurements and information on this certificate are valid at time of calibration only and any number of factors may cause calibration to drift out of tolerance prior to calibration due date.

This instrument has been calibrated using standards with accuracies traceable to the National Institute of Standards and Technology, derived from natural physical constants, from ratio measurements, or compared to consensus standards.

The expanded uncertainty of the measurement process has not exceeded 25% of the tolerance allowed for the individual characteristics measured, unless otherwise stated. The uncertainties are based on a 95% confidence level, K=2.

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Approved by: Vice President

Printed: 8/23/2012 13:08:36

Date: Aug 19, 2012

JH Metrology Co, Inc. • 1801 Hicks Road, Unit E • Rolling Meadows, Illinois 60008 • Phone: (847) 991-0290 • Fax: (847) 991-0348

TROEMNER

Henry Troemner LLC

Traceable Certificate For Scale S/N 8028301068

201 Wolf Drive • P.O. Box 87 • Thorofare, NJ 08086-0087 • Phone:856-686-1600 • Fax: 856-686-1601 • www.troemner.com • e-mail: troemner@troemner.com

Weight

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067

Order Number	CC
Certificate Number	717866
Date Of Calibration	29-APR-2013
Calibration Due Date	29-APR-2014
As Found	In Tolerance
As Left	In Tolerance

Description of Weights: Analytical Weight

Material	Assumed Density at 20°C	Range
Stainless Steel	8.03 g/cm3	500g

Tested with Reference Standards Traceable to the National Institute of Standards & Technology through NIST Test Number 822-275872-11.

We certify that the weights listed are calibrated to ASTM E617-97 Class 1 tolerances.

The calibration of these weights is based on apparent mass vs material of density 8.0g/cm3.

Nominal Mass Value Notes	Serial Number	Correction before Calibration *	Correction after Calibration *	Tolerance (+ or -)	Uncertainty (+ or -)
500 g	60150	+0.3408 mg	+0.3408 mg	1.200 mg	0.40 mg

* Correction is defined as the difference between the mass value of a weight and its nominal value. A positive correction indicates that the mass value is greater than the nominal value by the amount of the correction.

Joseph Moran, Metrology Manager, Approved Signatory

1 As Found / 1 Total

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FIELD DATA

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I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

CleanAir.

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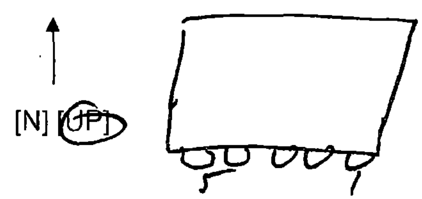
TEST LOCATION: FF Outlet Metals **TESTING** METHOD: 29 PAGE 1 OF 2

UNIT: 3 RUN: 1

FIELD DATA SHEET

Client: Wheelabrator		Project No: 12218	
Plant: N. Broward		Date: 6/4/13	
Meter Operator: P. Bihun			
Probe Operator: P. Bihun			
Meter Box: 66-13		Sample Box No: M10	
Meter Y_d: 0.9976		Meter $\Delta H_@$: 1.7594	
K Factor: 2.54		Pitot C_p: 0.814	
Leak Rate Before: 0.003 [cfm] [Lpm] @ 11 (in. Hg)			
Leak Rate After: 0.003 [cfm] [Lpm] @ 10 (in. Hg)			
Pitot Leak Check Before: ☒		After: Good ☒ Bad ☐	

Cross-Section of Test Location



Duct Dimensions (in.): 96x96			
Static Pres (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
-9.3	10.0	In	In

Amb. Temp. (°F): 85		Bar. Press: 30.05 [in. Hg] [mbar]	
Probe I.D. No.: 66-8-1			
Liner Material: Glass			
Filter No.: N/A			
Thimble No.: N/A			
Nozzle Diameter: 0.221		Nozzle I.D.: 221-1	
Start Time: 11:51		Stop Time: 14:03	

Traverse Point Number	Min/pt 5 Elapsed Time	Velocity Head ΔP (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume V_m Init. Vol: [ft³] [L] 150.055	Stack Temp. Ts (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes O_2	
5-1	5	0.55	1.4	153.45	285	255	256	65 (86 PB 6/4/13)	86	86	5.5	N/A	9.4	
2	10	0.60	1.5	156.92	284	252	252	65	88	86	6.0	↓	9.1	
3	15	0.55	1.4	160.28	284	251	250	63	93	86	5.5		9.3	
4	20	0.47	1.2	163.41	284	250	250	62	96	87	5.0		8.8	
5	25	0.45	1.1	166.410	285	249	252	63	98	88	5.0		8.4	166.455
4-1	30	0.56	1.4	169.82	284	250	251	64	96	89	5.5		8.5	-0.045
2	35	0.57	1.5	173.33	285	249	249	65	99	90	6.0		8.6	
3	40	0.52	1.3	176.61	286	251	249	66	100	90	5.5		8.1	
4	45	0.47	1.2	179.78	285	251	250	60	101	91	5.0		8.3	
5	50	0.43	1.1	182.800	285	249	249	58	102	93	5.0		8.2	182.865
3-1	55	0.50	1.3	186.13	283	249	251	60	101	93	5.5		8.2	-0.065
2	60	0.55	1.4	189.50	284	250	250	59	103	94	5.5		8.2	
Total		*		~~83.090~~					4023					
Average		0.7267	1.3520		285.3000				96.4600					

* Sum of square roots. 15.8

83.100 SB 6/25/13 3414

2236

Circle correct bracketed units on data sheet.

QA/QC PB

Date 6/4/13

CleanAir ENGINEERING

FDS005-General.xls, Feb 2002

E - 3

TEST LOCATION: FF Outlet Metals TESTING METHOD: 29 PAGE 2 OF 2

UNIT: 3 RUN: 1

FIELD DATA SHEET

Client	Wheelabrator	Project No.	12218
Plant	N. Brunswick	Date	6/14/13
Meter Operator		P. Bilyeu	
Probe Operator		P. Bilyeu	

Cross-Section of Test Location

[N] [UP]

Amb. Temp. (°F)	Bar. Press. [in. Hg] [mbar]
Probe I.D. No.	
Liner Material	

Meter Box	Sample Box No.	
Meter Y_d	Meter $\Delta H_@$	
K Factor	Pitot C_p	
Leak Rate Before	[cfm] [Lpm] @	(in. Hg)
Leak Rate After	[cfm] [Lpm] @	(in. Hg)
Pitot Leak Check Before ☐	After: Good ☐ Bad ☐	

Duct Dimensions (in.)			
Static Pres (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]

Filter No.		
Thimble No.		
Nozzle Diameter	Nozzle I.D.	

Start Time:	Stop Time:

Traverse Point Number	Min/pt 5 Elapsed Time	Velocity Head ΔP (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume V_m Init. Vol. (ft³) [L]	Stack Temp. Ts (°F)	Probe T_p (°F) Set Points 280	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in Hg)	XAD Trap Temp T_t (°F)	Notes O_2
3	65	0.55	1.4	192.89	284	249	249	59	104	95	6.0	N/A	8.9
4	70	0.50	1.3	196.14	285	251	251	60	105	96	5.5		8.7
5	75	0.45	1.1	199.120	284	250	250	61	105	96	5.0		9.3
2-1	80	0.58	1.5	202.71	282	250	251	63	103	96	6.5		9.4
2	85	0.57	1.5	206.19	284	249	250	64	103	97	6.5		8.7
3	90	0.57	1.5	209.68	285	250	250	64	103	96	6.5		8.6
4	95	0.57	1.5	213.16	285	251	250	65	103	96	6.5		8.7
5	100	0.60	1.5	216.655	284	250	251	65	102	96	6.5		9.1
1-1	105	0.51	1.3	219.96	281	249	248	65	101	96	6.0		10.5
2	110	0.55	1.4	223.40	285	249	251	64	102	96	6.5		10.7
3	115	0.55	1.4	226.83	293	250	252	65	102	96	6.5		9.0
4	120	0.50	1.3	230.13	294	251	250	65	103	96	6.0		9.1
5	125	0.51	1.3	233.410	293	250	250	65	103	96	6.0		8.2
	Total	*											
	Average												

199.220 −0.10

216.705 −0.045

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC PB

Date 6/14/13

CleanAir ENGINEERING

TEST LOCATION: FR Outlet Metals TESTING METHOD: 29 PAGE 1 OF 2

UNIT: 3 RUN: 2

FIELD DATA SHEET

Client	Wheelabrator	Project No.	12214
Plant	Ft. Broward	Date	6/5/13
Meter Operator	R. Bihun		
Probe Operator	R. Bihun		

Cross-Section of Test Location

Amb. Temp. (°F)	82	Bar. Press.	29.95 (in. Hg) [mbar]
Probe I.D. No.	66-64		
Liner Material	Glass		

Meter Box	66-63	Sample Box No.	M11
Meter Y_d	0.9926	Meter $\Delta H_@$	1.7534
K Factor	2.44	Pitot C_p	0.814
Leak Rate Before	0.004 [cfm] [Lpm]	@ 15	(in. Hg)
Leak Rate After	0.004 [cfm] [Lpm]	@ 10	(in. Hg)
Pitot Leak Check Before	X	After Good X Bad ☐	

Filter No.	N/A		
Thimble No.	N/A		
Nozzle Diameter	0.221	Nozzle I.D.	225-4

Duct Dimensions (in.) 96x96

Static Pres (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
-9.8	10.0		

Start Time: 7:32 Stop Time: 9:44

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume V_m Init. Vol. 233.770 [ft³] [L]	Stack Temp Ts (°F)	Probe T_p (°F) Set Points	Filter T_f (°F) Set Points	Cond. Temp T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp (°F)	Notes
5-1	5	0.57	1.4	237.14	290	253	256	65	85	84	7.0	10.1	K=2.42
2	10	0.50	1.2	240.27	289	251	253	65	88	84	6.5	9.4	
3	15	0.49	1.2	243.39	288	252	251	61	91	85	7.0	9.1	
4	20	0.47	1.1	246.40	286	250	250	59	94	85	6.5	8.6	
5	25	0.47	1.1	249.400	286	250	250	60	96	86	6.5	8.7	249.440
4-1	30	0.50	1.2	252.56	283	249	249	62	96	87	6.5	8.9	-0.040
2	35	0.47	1.1	255.59	284	249	251	62	99	88	6.5	8.4	
3	40	0.47	1.1	258.61	285	250	250	63	100	89	6.5	8.6	
4	45	0.45	1.1	261.63	285	250	250	63	101	90	6.5	8.2	
5	50	0.41	0.99	264.420	285	250	250	64	100	90	5.5	8.3	264.480
3-1	55	0.55	1.3	267.71	283	249	249	65	98	91	7.0	8.7	-0.060
2	60	0.53	1.3	271.03	286	249	249	65	99	91	7.0	7.9	
	Total	*		38.050									
	Average	0.7020	1.1916		285.5600				94.4200				
		Sum of square roots	14.09						2.197				

Circle correct bracketed units on data sheet. 3431

QA/QC RB

Date 6/5/13

CleanAir ENGINEERING

TEST LOCATION: FF Outlet Metals TESTING METHOD: 29 PAGE 2 OF 2

UNIT: 3 RUN: 2

FIELD DATA SHEET

Client	Wheelabrator	Project No.	6218
Plant	N. Broward	Date	6/11/13
Meter Operator		P. Bilyeu	
Probe Operator		P. Bilyeu	

Meter Box	Sample Box No.
Meter Y_d	Meter $\Delta H_@$
K Factor	Pitot C_p
Leak Rate Before [cfm] [Lpm]	@ (in Hg)
Leak Rate After [cfm] [Lpm]	@ (in Hg)
Pitot Leak Check Before ☐	After Good ☐ Bad ☐

Cross-Section of Test Location

[N] [UP]

Duct Dimensions (in.)

Static Pres (in. H_2O)	Port Len (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]

Amb. Temp. (°F)	Bar. Press. [in. Hg] [mbar]
Probe I.D. No.	
Liner Material	

Filter No.		
Thimble No.		
Nozzle Diameter	Nozzle I.D.	

Start Time:	Stop Time:

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in H_2O)	Orifice Setting ΔH (in H_2O)	Gas Sample Volume V_m Init. Vol. (ft³) [L]	Stack Temp Ts (°F)	Probe T_p (°F) Set Points 280	Filter T_f (°F) Set Points 250	Cond. Temp T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in Hg)	XAD Trap Temp (°F)	Notes
3	65	0.51	1.2	274.19	285	251	250	62	101	92	6.5	9.3	
4	70	0.49	1.2	277.37	287	250	252	62	101	92	7.0	9.1	
5	75	0.52	1.3	280.630	287	250	250	62	101	93	7.0	9.2	280.630
2-1	80	0.52	1.3	283.95	285	250	249	64	99	93	7.0	8.9	-0.05
2	85	0.52	1.3	287.21	285	249	250	64	101	93	7.0	9.0	
3	90	0.55	1.3	290.44	285	251	250	64	101	93	7.0	9.1	
4	95	0.50	1.2	293.64	286	251	251	64	102	93	7.0	8.5	
5	100	0.53	1.3	296.885	286	250	251	65	101	93	7.0	8.8	296.925
1-1	105	0.48	1.2	300.06	283	249	250	66	100	93	6.5	8.6	-0.04
2	110	0.45	1.1	303.04	283	249	250	66	101	93	6.5	8.2	
3	115	0.50	1.2	306.14	284	251	251	64	102	94	7.0	9.0	
4	120	0.42	1.0	308.99	286	251	251	63	102	94	6.0	9.4	
5	125	0.47	1.1	312.015	286	250	252	63	102	94	6.5	8.7	
	Total												
	Average												

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KB

Date 6/11/13

CleanAir ENGINEERING

TEST LOCATION: PC Outlet Metals TESTING METHOD: 29 PAGE 1 OF 2

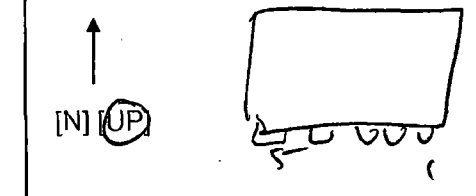
UNIT: 3 RUN: 3

FIELD DATA SHEET

Client	Wheelabrator	Project No.	12218
Plant	Broward	Date	4/5/13
Meter Operator	P. Bihun		
Probe Operator	P. Bihun		

Meter Box	66-13	Sample Box No.	M1U
Meter Y_d	0.9976	Meter $\Delta H_@$	1.75 94
K Factor	2.42	Pitot C_p	0.84
Leak Rate Before	0.003 [cfm] [Lpm]	@	15 (in. Hg)
Leak Rate After	0.003 [cfm] [Lpm]	@	10 (in. Hg)
Pitot Leak Check Before:	X	After: Good	X Bad ☐

Cross-Section of Test Location



Duct Dimensions (in.)	96 x 96		
Static Pres ($in. H_2O$)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
-10.0	10.0		

Amb. Temp. (°F)	86	Bar. Press.	29.91 [in. Hg] [mbar]
Probe I.D. No.	66-8-1		
Liner Material	Glass		

Filter No.	N/A		
Thimble No.	N/A		
Nozzle Diameter	0.225	Nozzle I.D.	225-1

Start Time:	10:02	Stop Time:	12:13

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP ($in. H_2O$)	Orifice Setting ΔH ($in. H_2O$)	Gas Sample Volume V_m [ft³] [L] Init. Vol. 312.380	Stack Temp. Ts (°F)	Probe T_p (°F) Set Points 280	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_x (°F) 68 / 68	Notes
5-1	5	0.45	1.1	315.42	283	256	253	66	94	93	4.5	9.2	
2	10	0.50	1.2	318.54	286	256	256	64	97	93	5.0	9.0	
3	15	0.45	1.1	321.46	286	254	251	61	99	93	4.5	8.5	
4	20	0.43	1.0	324.27	285	251	252	61	99	93	4.0	8.4	
5	25	0.38	0.92	326.955	286	251	249	61	99	93	4.0	8.3	327.041
4-1	30	0.47	1.1	330.01	285	248	249	62	98	93	4.5	8.4	-0.06
2	35	0.48	1.2	333.11	285	249	251	63	99	93	5.0	8.9	
3	40	0.45	1.1	336.09	285	251	249	64	100	94	4.1	8.4	
4	45	0.50	1.2	339.26	284	250	251	65	101	94	5.0	9.0	
5	50	0.43	1.0	342.060	286	251	249	63	102	94	4.0	9.0	342.115
3-1	55	0.36	0.87	344.74	285	249	250	62	100	94	4.0	9.7	-0.055
2	60	0.50	1.2	347.85	286	249	251	63	101	95	5.0	9.0	
	Total	*		72.975									
	Average	0.6625	1.0644		285.1600				97.5000				

Sum of square roots: 12.99 1.0644

Circle correct bracketed units on data sheet.

QA/QC CB

Date 6/5/13

CleanAir ENGINEERING

TEST LOCATION: PF Outlet — Metals TESTING METHOD: 29 PAGE 2 OF 2

UNIT: 3 RUN: 3

FIELD DATA SHEET

Client	Wheelabrator	Project No.	12218
Plant	N. Broward	Date	6/5/13
Meter Operator		R. Bishop	
Probe Operator		R. Bishop	

Meter Box		Sample Box No.	
Meter Y_d		Meter $\Delta H_@$	
K Factor		Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before ☐	After Good ☐	Bad ☐	

Cross-Section of Test Location

[N] [UP]

Duct Dimensions (in.)			
Static Pres (in. H_2O)	Port Len (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter	Nozzle I.D.	

Start Time:	Stop Time:

Traverse Point Number	Min/pt 5 Elapsed Time	Velocity Head ΔP (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume V_m Init. Vol. (ft³) [L]	Stack Temp. Ts (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp T_x (°F) 0.2 per filter	Notes
3	65	0.50	1.2	350.96	286	251	250	62	103	95	5.0	8.3	
4	70	0.45	1.1	353.99	288	251	250	63	103	95	5.0	8.1	
5	75	0.37	0.90	356.660	287	250	249	63	104	96	4.0	8.4	356.200
2-1	80	0.53	1.3	359.96	284	249	249	65	102	96	5.5	8.8	-0.04
2	85	0.50	1.2	363.11	286	248	249	65	102	96	5.0	8.6	
3	90	0.43	1.0	365.93	286	252	249	60	102	96	4.5	7.8	
4	95	0.44	1.1	368.92	285	252	250	59	101	95	5.0	8.1	
5	100	0.41	0.99	371.705	286	250	250	60	101	96	4.5	8.8	321.280
1-4	105	0.38	0.92	374.43	279	249	250	62	100	95	4.5	8.8	-0.075
2	110	0.38	0.92	377.14	280	249	248	62	100	95	4.5	8.7	
3	115	0.33	0.80	379.65	284	250	251	63	102	95	4.0	8.9	
4	120	0.41	0.99	382.43	287	251	251	64	102	95	4.5	8.2	
5	125	0.48	1.2	385.585	287	250	252	65	102	95	5.1	8.8	
	Total *												
	Average												

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC PB

Date 6/5/13

CleanAir ENGINEERING

TEST LOCATION: FC Outlet Metals TESTING METHOD: 29 PAGE 1 OF 2

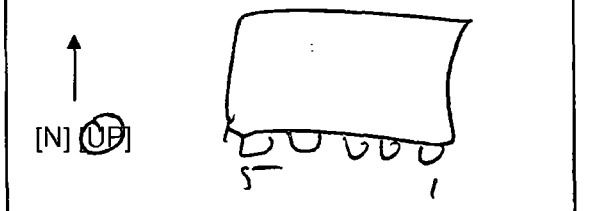
UNIT: 3 RUN: 4

FIELD DATA SHEET

Client	Wheelabrator	Project No.	12218
Plant	N. Brunswick	Date	6/5/13
Meter Operator	P. Bihun		
Probe Operator	P. Bihun		

Meter Box	66-13	Sample Box No.	M11
Meter Y_d	0.9926	Meter $\Delta H_@$	1.7594
K Factor	2.42	Pitot C_p	0.84
Leak Rate Before	0.003 [cfm] [Lpm]	@	15 (in. Hg)
Leak Rate After	0.003 [cfm] [Lpm]	@	10 (in. Hg)
Pitot Leak Check Before	X	After: Good X	Bad ☐

Cross-Section of Test Location



Duct Dimensions (in.)	96x96		
Static Pres ($in. H_2O$)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
-9.9	10.0		

Amb. Temp. (°F)	87	Bar. Press.	29.91 (in. Hg) [mbar]
Probe I.D. No.	66-8-1		
Liner Material	Glass		

Filter No.	N14	
Thimble No.	N11	
Nozzle Diameter	0.277	Nozzle I.D. 277-1

Start Time:	12:30	Stop Time:	14:42

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP ($in. H_2O$)	Orifice Setting ΔH ($in. H_2O$)	Gas Sample Volume V_m Init. Vol. 386.035 [ft³] [L]	Stack Temp. Ts (°F)	Probe T_p (°F) Set Points	Filter T_f (°F) Set Points	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in Hg)	XAD Trap Temp. T_x (°F) O_2 13.6643	Notes
						250	250						
5-1	5	0.44	1.1	389.03	283	249	254	66	95	94	5.1	8.9	
2	10	0.47	1.1	391.28	286	257	251	63	98	94	5.5	9.3	
3	15	0.50	1.2	395.10	286	254	250	59	100	95	6.5	8.8	
4	20	0.45	1.1	398.13	286	251	250	59	102	95	6.0	8.6	
5	25	0.37	0.90	400.800	285	250	251	61	103	96	5.0	8.8	
4-1	30	0.48	1.2	403.97	284	250	250	63	101	96	6.5	9.2	400.840
2	35	0.50	1.2	407.09	285	249	250	64	103	96	6.5	9.2	-0.04
3	40	0.45	1.1	410.09	285	250	250	64	104	96	6.0	9.0	
4	45	0.41	0.99	412.91	285	251	250	64	104	96	5.5	9.0	
5	50	0.42	1.0	415.750	286	250	250	65	104	96	5.5	9.2	415.800
3-1	55	0.36	0.87	418.43	283	250	250	65	102	97	4.5	9.7	-0.05
2	60	0.42	1.0	421.26	286	249	251	60	103	97	5.5	8.9	
	Total	*		74.750									
	Average	0.6665	1.1064		285.5200				100.1000				

Sum of square roots 12.196

Circle correct bracketed units on data sheet.

3420 QA/QC 11.3

Date 6/5/13

2367

E-6

CleanAir ENGINEERING

TEST LOCATION: FF outlet Metals **TESTING** **METHOD:** 29 **PAGE** 2 **OF** 2

UNIT: 3 **RUN:** 4

FIELD DATA SHEET

Client	Wheelabrator	Project No.	12218
Plant	Ft. Broward	Date	6/5/13
Meter Operator		P. Behun	
Probe Operator		P. Behun	

Cross-Section of Test Location

[N] [UP]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]	
Probe I.D. No.			
Liner Material			

Meter Box	Sample Box No.		
Meter Y_d	Meter $\Delta H_@$		
K Factor	Pitot C_p		
Leak Rate Before	[cfm] [Lpm] @	(in. Hg)	
Leak Rate After	[cfm] [Lpm] @	(in. Hg)	
Pitot Leak Check Before ☐	After Good ☐ Bad ☐		

Filter No.			
Thimble No.			
Nozzle Diameter	Nozzle I.D.		

Duct Dimensions (in.)			
Static Pres ($in. H_2O$)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]

Start Time:	Stop Time:

Traverse Point Number	Min/pt 5 Elapsed Time	Velocity Head ΔP ($in. H_2O$)	Orifice Setting ΔH ($in. H_2O$)	Gas Sample Volume V_m Init. Vol. (ft³) [L]	Stack Temp. Ts (°F)	Probe T_p (°F) Set Points	Filter T_f (°F) Set Points	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\,in}$ (°F)	DGM Outlet $T_{m\,out}$ (°F)	Pump Vacuum (in.Hg)	XAD Trap Temp T_{x_2} (°F)	Notes
						250	250					6/6/13	
3	65	0.41	1.0	424.05	286	250	250	59	104	97	5.5	8.5	T_{x_2} 2.54
4	70	0.48	1.2	427.23	287	250	250	59	105	97	6.5	9.6	
5	75	0.40	1.0	430.055	285	250	249	60	106	98	5.5	9.2	430.45
2-1	80	0.60	1.5	433.55	286	250	249	62	104	98	7.5	8.9	-0.016
2	85	0.50	1.3	436.84	286	249	249	63	106	98	7.0	7.7	
3	90	0.49	1.3	440.13	286	251	250	63	106	98	7.0	8.8	
4	95	0.42	1.1	443.16	287	251	250	64	106	98	6.0	7.0	
5	100	0.44	1.1	446.160	284	250	250	65	106	98	6.0	8.5	446.215
1-1	105	0.40	1.0	449.04	282	249	249	59	104	98	5.5	9.7	-0.057
2	110	0.42	1.1	452.03	288	249	250	56	104	98	6.0	9.1	
3	115	0.45	1.1	455.02	286	251	251	55	105	98	6.5	9.4	
4	120	0.442	1.1	~~458.00~~ 458.000 ft³/13	286	250	250	56	105	98	6.5	8.5	
5	125	0.44	1.1	460.990	286	251	249	56	105	98	6.5	8.2	
	Total	*											
	Average												

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC RB

Date 6/6/13

CleanAir ENGINEERING

Impinger Weight Sheet

Client Wheelabrator		Unit Name / Location Unit 3 FF Outlet
Plant North Broward	Job No. 12118	Method 29

Balance Calibration Check			
Balance ID	SN# 802830168	Reference Weight Mass	500.0
Reference Weight ID	60150	Reference Weight Reading	499.5

Check must be performed at least Once per Method per Job

Reference Weight Mass must agree with Reference Weight Reading to within ±0.5 g.

Run No. 1	Filter Type Quartz		Sample Box No. M10
Date 6/4/13 ~~9/5/2012~~	Lot No. NA		pH NA
Analyst R. Vicere	Filter No. Untared		Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	820.1	442.5	377.6	
Impinger 2	100 ml 5%HNO_3/10%H_2O_2	702.7	542.8	159.9	QA/QC RV
Impinger 3	100 ml 5%HNO_3/10%H_2O_2	596.2	564.2	32.0	Date 6/4/13
Impinger 4	Empty	456.0	447.7	8.3	
Impinger 5	100 ml 4%$KMnO_4$/10%H_2SO_4	636.1	630.9	5.2	Total Weight (gm)
Impinger 6	100 ml 4%$KMnO_4$/10%H_2SO_4	554.6	554.0	0.6	583.6
Impinger 7	≈250 g Silica Gel	784.7	765.5	19.2	602.8

Run No. 2	Filter Type Quartz		Sample Box No. M11
Date 6/5/13 ~~9/6/2012~~	Lot No. NA		pH NA
Analyst R. Vicere	Filter No. Untared		Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	797.1	435.0	362.1	
Impinger 2	100 ml 5%HNO_3/10%H_2O_2	701.8	548.9	152.9	QA/QC RV
Impinger 3	100 ml 5%HNO_3/10%H_2O_2	565.8	531.6	34.2	Date 6/5/13
Impinger 4	Empty	432.1	424.8	7.3	
Impinger 5	100 ml 4%$KMnO_4$/10%H_2SO_4	547.2	541.6	5.6	Total Weight (gm)
Impinger 6	100 ml 4%$KMnO_4$/10%H_2SO_4	541.4	541.1	0.3	562.4
Impinger 7	≈250 g Silica Gel	765.9	747.4	18.5	580.9

Run No. 3	Filter Type Quartz		Sample Box No. M10
Date 6/5/13	Lot No. NA		pH NA
Analyst R. Vicere	Filter No. Untared		Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)		
Impinger 1	Empty	786.2	445.4	340.8	0	
Impinger 2	100 ml 5%HNO_3/10%H_2O_2	672.4	547.2	125.2	0	QA/QC RV
Impinger 3	100 ml 5%HNO_3/10%H_2O_2	587.9	569.1	18.8	0	Date 6/5/13
Impinger 4	Empty	453.6	449.2	4.4	0	
Impinger 5	100 ml 4%$KMnO_4$/10%H_2SO_4	637.0	633.8	3.2	0	Total Weight (gm)
Impinger 6	100 ml 4%$KMnO_4$/10%H_2SO_4	560.3	559.5	0.8	0	493.2 0
Impinger 7	≈250 g Silica Gel	797.5	783.8	13.7	0	506.9 0

QA/QC RV
Date 6/5/13

CleanAir. ENGINEERING

Impinger Weight Sheet

Client Wheelabrator		Unit Name / Location Unit 3 FF Outlet
Plant North Broward	Job No. 12118	Method 29

Balance Calibration Check			
Balance ID	S.W.H 8028301068	Reference Weight Mass	5000
Reference Weight ID	60150	Reference Weight Reading	499.5

Check must be performed at least Once per Method per Job

Reference Weight Mass must agree with Reference Weight Reading to within ±0.5 g.

Run No. 4	Filter Type Quartz		Sample Box No. M11
Date 6/5/13 ~~9/6/2012~~	Lot No. NA		pH NA
Analyst R. Vicere	Filter No. Untared		Rinse NA

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 ml 0.1 N H2SO4	774.4	436.9	337.5	
Impinger 2	100 ml 0.1 N H2SO4	667.3	552.0	115.3	QA/QC RV
Impinger 3	Empty	554.2	530.9	23.3	Date 6/5/13
Impinger 4	Empty	430.9	426.8	4.1	
Impinger 5	100 ml 4%$KMnO_4$/10%H_2SO_4	550.3	546.1	4.2	Total Weight (gm)
Impinger 6	100 ml 4%$KMnO_4$/10%H_2SO_4	542.7	542.0	6.7	485.1
Impinger 7	≈250 g Silica Gel	780.9	765.5	15.4	500.5

Run No.	Filter Type		Sample Box No.
Date	Lot No.		pH
Analyst	Filter No.		Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1					
Impinger 2					QA/QC
Impinger 3					Date
Impinger 4					
Impinger 5					Total Weight (gm)
Impinger 6					
Impinger 7					

Run No.	Filter Type		Sample Box No.
Date	Lot No.		pH
Analyst	Filter No.		Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1				0	
Impinger 2				0	QA/QC
Impinger 3				0	Date
Impinger 4				0	
Impinger 5				0	Total Weight (gm)
Impinger 6				0	0
Impinger 7				0	0

QA/QC RV
Date 6/5/13

CleanAir. ENGINEERING

ORSAT READINGS

TEST LOCATION: RF Outlet **PAGE** 1 **OF** 1

Client	Wheelabrator	Project Number	12218
Plant	N. Broward	Unit	3
Orsat ID	OF	Fuel Type	MSW

$$Fo = \frac{20.9 - \%O_2}{\%CO_2}$$

Leak Check Passed ☒

Run Number	Method Number	Trial	Percent CO_2	Percent O_2+CO_2	Percent O_2	Fo	Analyst	Analysis Date	Analysis Time
1	3	1	9.8	19.0	9.2	1.2	P. Bihum	6/4/13	15:04
		2	9.8	18.8	9.0				
		3	9.8	19.0	9.2				
		Avg.	9.8	18.9	9.1				
2	3	1	10.2	19.4	9.2	1.16	R. Vicar	6/5/13	11:24
		2	10.1	19.3	9.2				
		3	10.1	19.4	9.3				
		Avg.	10.1	19.4	~~19.2~~ 9.2				
3	3	1	9.4	18.8	9.4	1.22	R. Vicar	6/5/13	14:02
		2	9.4	18.8	9.4				
		3	9.4	18.8	9.4				
		Avg.	9.4	18.8	9.4				
4	3	1	9.6	18.8	9.2	1.22	R. Vicar	6/5/13	16:18
		2	9.6	18.8	9.2				
		3	9.8	18.8	9.0				
		Avg.	9.7	18.8	9.1				
		1							
		2							
		3							
		Avg.							
		1							
		2							
		3							
		Avg.							

Repeat the analysis procedure until the results of any three analyses differ by no more than 0.2 percent by volume Average the three acceptable values and report the results to the nearest 0.1 percent. Calculate$_0$ to verify results

Acceptable ranges for F_0:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

QA/QC [illegible]
Date 6/5/13

CleanAir ENGINEERING

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FIELD DATA PRINTOUTS

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I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

CleanAir.

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Field Data Printout

Test Method: **USEPA Method 29**
Analyte: **Trace Metals**

Location: Unit 3 FF Outlet
Test Run: 1
Client: Wheelabrator North Broward, Inc.
Project No: 12218
Source Area (ft^2): 64.00000
Meter Operator: P. Bihun 505
Probe Operator: P. Bihun 505
Test Date: 6/04/13
Start Time: 11:51
Stop Time: 14:03
Leak Rate Before: 0.003 cfm @ 15 "Hg
Leak Rate After: 0.003 cfm @ 10 "Hg

Bar. Press. (in. Hg): 30.05
Static P: -9.3
O_2 (dry volume %): 9.13
CO_2 (dry volume %): 9.80
N_2+CO (dry volume %): 81.07
H_2O (condensate, ml or gm): 583.6
H_2O (silica, g): 19.2
Actual Moisture (%): 26.36

Nozzle ID No: 275-1
Nozzle Diameter (D_n): 0.275
Probe ID No: 66-8-1
Pitot C_p: 0.814
Pitot Leak Check: ☑ Pass ☐ Fail
Meter Box ID. No: 66-13
Meter ΔH@: 1.75940
Meter Y_d: 0.99760

Traverse Point	Run Time 5.0 min/read	Pitot ΔP_s (in. H_2O)	Sample ΔH (in. H_2O)	Metered (dcf)	Stack T_s (°F)	Dry Gas Meter $T_{m\text{-}in}$ (°F)	Dry Gas Meter $T_{m\text{-}out}$ (°F)	$\sqrt{\Delta P_s}$ (calculated) ($\sqrt{in.}$ H_2O)	Volume (calculated) (ft^3)	Isokinetics (calculated) (%)
	0.0			150.055						
5-01	5.0	0.55	1.40	153.450	285	86	86	0.74	3.39	103.7
5-02	10.0	0.60	1.50	156.920	284	88	86	0.77	3.47	101.3
5-03	15.0	0.55	1.40	160.280	284	93	86	0.74	3.36	101.9
5-04	20.0	0.47	1.20	163.410	284	96	87	0.69	3.13	102.3
5-05	25.0	0.45	1.10	166.410	285	98	88	0.67	3.00	100.0
LEAK CHECK	25.0			166.455						
4-01	30.0	0.56	1.40	169.820	284	96	89	0.75	3.36	100.6
4-02	35.0	0.57	1.50	173.330	285	99	90	0.75	3.51	103.7
4-03	40.0	0.52	1.30	176.610	286	100	90	0.72	3.28	101.4
4-04	45.0	0.47	1.20	179.780	285	101	91	0.69	3.17	102.8
4-05	50.0	0.43	1.10	182.800	285	102	93	0.66	3.02	102.1
LEAK CHECK	50.0			182.865						
3-01	55.0	0.50	1.30	186.130	283	101	93	0.71	3.26	102.4
3-02	60.0	0.55	1.40	189.500	284	103	94	0.74	3.37	100.6
3-03	65.0	0.55	1.40	192.890	284	104	95	0.74	3.39	101.0
3-04	70.0	0.50	1.30	196.160	285	105	96	0.71	3.27	102.0
3-05	75.0	0.45	1.10	199.120	284	105	96	0.67	2.96	97.2
LEAK CHECK	75.0			199.220						
2-01	80.0	0.58	1.50	202.710	282	103	96	0.76	3.49	101.1
2-02	85.0	0.57	1.50	206.190	285	103	97	0.75	3.48	101.8
2-03	90.0	0.57	1.50	209.680	285	103	96	0.75	3.49	102.2
2-04	95.0	0.57	1.50	213.160	285	103	96	0.75	3.48	101.9
2-05	100.0	0.60	1.50	216.655	284	102	96	0.77	3.50	99.8
LEAK CHECK	100.0			216.700						
1-01	105.0	0.51	1.30	219.960	281	101	96	0.71	3.26	100.8
1-02	110.0	0.55	1.40	223.400	285	102	96	0.74	3.44	102.6
1-03	115.0	0.55	1.40	226.830	293	102	96	0.74	3.43	102.9
1-04	120.0	0.50	1.30	230.130	294	103	96	0.71	3.30	103.8
1-05	125.0	0.51	1:30	233.410	293	103	96	0.71	3.28	102.1
Final	125.0		1.35200	83.10000	285.36000	96.46000		0.72672	83.10000	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.7267	1.3520	83.1000	285.3600	96.4600				
		☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

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SS ISOKINETIC Version 2006-13e

Field Data Printout

Location:	Unit 3 FF Outlet	Test Method:	USEPA Method 29
Test Run:	2	Analyte:	Trace Metals
Client:	Wheelabrator North Broward, Inc.	Bar. Press. (in. Hg):	29.95
Project No:	12218	Static P:	-9.8
Source Area (ft^2):	64.00000	O_2 (dry volume %):	9.23
Meter Operator:	P. Bihun 505	CO_2 (dry volume %):	10.13
Probe Operator:	P. Bihun 505	N_2+CO (dry volume %):	80.63
Test Date:	6/05/13		
Start Time:	07:32		
Stop Time:	09:44	H_2O (condensate, ml or gm):	562.4
Leak Rate Before:	0.004 cfm @ 15 "Hg	H_2O (silica, g):	18.5
Leak Rate After:	0.004 cfm @ 10 "Hg	Actual Moisture (%):	26.87

Nozzle ID No:	275-1		
Nozzle Diameter (D_n):	0.275		
Probe ID No:	66-8-1		
Pitot C_p:	0.814		
Pitot Leak Check:	☑ Pass ☐ Fail		
Meter Box ID. No:	66-13		
Meter ΔH@:	1.75940		
Meter Y_d:	0.99760		

Traverse Point	Run Time 5.0 min/read	Pitot ΔP_s	Sample ΔH	Metered	Stack T_s	Dry Gas Meter $T_{m\text{-}in}$	Dry Gas Meter $T_{m\text{-}out}$	$\sqrt{\Delta P_s}$	Volume	Isokinetics
	0.0	(in. H_2O)	(in. H_2O)	233.770	(°F)	(°F)	(°F)	(calculated) (√in. H_2O)	(calculated) (ft^3)	(calculated) (%)
5-01	5.0	0.57	1.40	237.140	290	85	84	0.75	3.37	102.3
5-02	10.0	0.50	1.20	240.270	289	88	84	0.71	3.13	101.1
5-03	15.0	0.49	1.20	243.390	288	91	85	0.70	3.12	101.3
5-04	20.0	0.47	1.10	246.400	286	94	85	0.69	3.01	99.4
5-05	25.0	0.47	1.10	249.400	286	96	86	0.69	3.00	98.8
LEAK CHECK	25.0			249.445						
4-01	30.0	0.50	1.20	252.560	283	96	87	0.71	3.12	99.2
4-02	35.0	0.47	1.10	255.549	285	99	88	0.69	2.99	97.9
4-03	40.0	0.47	1.10	258.610	285	100	89	0.69	3.06	100.1
4-04	45.0	0.45	1.10	261.630	285	101	90	0.67	3.02	100.7
4-05	50.0	0.41	0.99	264.420	285	100	90	0.64	2.79	97.5
LEAK CHECK	50.0			264.480						
3-01	55.0	0.55	1.30	267.750	283	98	91	0.74	3.27	98.7
3-02	60.0	0.53	1.30	271.030	286	99	91	0.73	3.28	101.0
3-03	65.0	0.51	1.20	274.190	285	101	92	0.71	3.16	98.8
3-04	70.0	0.49	1.20	277.370	287	101	92	0.70	3.18	101.6
3-05	75.0	0.52	1.30	280.630	287	101	93	0.72	3.26	101.1
LEAK CHECK	75.0			280.680						
2-01	80.0	0.52	1.30	283.950	285	99	93	0.72	3.27	101.4
2-02	85.0	0.52	1.30	287.210	285	101	93	0.72	3.26	100.9
2-03	90.0	0.55	1.30	290.460	285	101	93	0.74	3.25	97.8
2-04	95.0	0.50	1.20	293.640	286	102	93	0.71	3.18	100.4
2-05	100.0	0.53	1.30	296.885	286	101	93	0.73	3.25	99.6
LEAK CHECK	100.0			296.925						
1-01	105.0	0.48	1.20	300.060	283	100	93	0.69	3.13	100.9
1-02	110.0	0.45	1.10	303.040	283	101	93	0.67	2.98	99.0
1-03	115.0	0.50	1.20	306.140	284	102	94	0.71	3.10	97.6
1-04	120.0	0.42	1.00	308.990	286	102	94	0.65	2.85	98.0
1-05	125.0	0.47	1.10	312.015	286	102	94	0.69	3.02	98.3
Final	125.0		1.19160	78.05000	285.56000	94.42000		0.70203	78.05000	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.7020	1.1916	78.0500	285.5600	94.4200				
		☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

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Field Data Printout

Test Method: USEPA Method 29
Analyte: Trace Metals

Location: Unit 3 FF Outlet
Test Run: 3
Client: Wheelabrator North Broward, Inc.
Project No: 12218
Source Area (ft^2): 64.00000
Meter Operator: P. Bihun 505
Probe Operator: P. Bihun 505
Test Date: 6/05/13
Start Time: 10:02
Stop Time: 12:13
Leak Rate Before: 0.003 cfm @ 15 "Hg
Leak Rate After: 0.003 cfm @ 10 "Hg

Bar. Press. (in. Hg): 29.95
Static P: -10.0
O_2 (dry volume %): 9.40
CO_2 (dry volume %): 9.40
N_2+CO (dry volume %): 81.20
H_2O (condensate, ml or gm): 493.2
H_2O (silica, g): 13.7
Actual Moisture (%): 25.64

Nozzle ID No: 275-1
Nozzle Diameter (D_n): 0.275
Probe ID No: 66-8-1
Pitot C_p: 0.814
Pitot Leak Check: ☑ Pass ☐ Fail
Meter Box ID. No: 66-13
Meter ΔH@: 1.75940
Meter Y_d: 0.99760

Traverse Point	Run Time 5.0 min/read	Pitot ΔP_s (in. H_2O)	Sample ΔH (in. H_2O)	Metered (dcf)	Stack T_s (°F)	Dry Gas Meter $T_{m\text{-}in}$ (°F)	Dry Gas Meter $T_{m\text{-}out}$ (°F)	$\sqrt{\Delta P_s}$ (calculated) ($\sqrt{}$in. H_2O)	Volume (calculated) (ft^3)	Isokinetics (calculated) (%)
	0.0			312.380						
5-01	5.0	0.45	1.10	315.420	283	94	93	0.67	3.04	100.1
5-02	10.0	0.50	1.20	318.540	286	97	93	0.71	3.12	97.4
5-03	15.0	0.45	1.10	321.460	286	99	93	0.67	2.92	95.9
5-04	20.0	0.43	1.00	324.270	285	99	93	0.66	2.81	94.3
5-05	25.0	0.38	0.92	326.955	286	99	93	0.62	2.69	95.9
LEAK CHECK	25.0			327.015						
4-01	30.0	0.47	1.10	330.010	285	98	93	0.69	3.00	96.3
4-02	35.0	0.48	1.20	333.150	285	99	93	0.69	3.14	99.8
4-03	40.0	0.45	1.10	336.090	285	100	94	0.67	2.94	96.3
4-04	45.0	0.50	1.20	339.260	286	101	94	0.71	3.17	98.5
4-05	50.0	0.43	1.00	342.060	286	102	94	0.66	2.80	93.7
LEAK CHECK	50.0			342.115						
3-01	55.0	0.36	0.87	344.740	285	100	94	0.60	2.63	96.1
3-02	60.0	0.50	1.20	347.850	286	101	95	0.71	3.11	96.6
3-03	65.0	0.50	1.20	350.960	286	103	95	0.71	3.11	96.4
3-04	70.0	0.45	1.10	353.990	288	103	95	0.67	3.03	99.1
3-05	75.0	0.37	0.90	356.660	287	104	96	0.61	2.67	96.0
LEAK CHECK	75.0			356.700						
2-01	80.0	0.53	1.30	359.960	284	102	96	0.73	3.26	98.0
2-02	85.0	0.50	1.20	363.110	286	102	96	0.71	3.15	97.6
2-03	90.0	0.43	1.00	365.930	286	102	96	0.66	2.82	94.2
2-04	95.0	0.44	1.10	368.920	285	101	95	0.66	2.99	98.9
2-05	100.0	0.41	0.99	371.705	286	101	96	0.64	2.78	95.4
LEAK CHECK	100.0			371.780						
1-01	105.0	0.38	0.92	374.430	279	100	95	0.62	2.65	94.0
1-02	110.0	0.38	0.92	377.140	280	100	95	0.62	2.71	96.2
1-03	115.0	0.33	0.80	379.650	284	102	95	0.57	2.51	95.6
1-04	120.0	0.41	0.99	382.430	287	102	95	0.64	2.78	95.3
1-05	125.0	0.48	1.20	385.585	287	102	95	0.69	3.15	100.0
Final	125.0		1.06440	72.97500	285.16000	97.50000		0.66245	72.97500	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.6625	1.0644	72.9750	285.1600	97.5000				
		☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

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Prepared by Clean Air Engineering Proprietary Software
SS ISOKINETIC Version 2006-13a

Field Data Printout

Test Method: **USEPA Method 29**
Analyte: **Trace Metals**

Location: Unit 3 FF Outlet
Test Run: 4
Client: Wheelabrator North Broward, Inc.
Project No: 12218
Source Area (ft^2): 64.00000

Meter Operator:		P. Bihun	505
Probe Operator:		P. Bihun	505

Test Date: 6/05/13
Start Time: 12:30
Stop Time: 14:42

Leak Rate Before:	0.003	cfm	@ 15 "Hg
Leak Rate After:	0.003	cfm	@ 10 "Hg

Bar. Press. (in. Hg): 29.95
Static P: -9.9
O_2 (dry volume %): 9.13
CO_2 (dry volume %): 9.67
N_2+CO (dry volume %): 81.20

H_2O (condensate, ml or gm): 485.1
H_2O (silica, g): 15.4
Actual Moisture (%): 25.03

Nozzle ID No: 275-1
Nozzle Diameter (D_n): 0.275
Probe ID No: 66-8-1
Pitot C_p: 0.814
Pitot Leak Check: ☑ Pass ☐ Fail

Meter Box ID. No: 66-13
Meter ΔH@: 1.75940
Meter Y_d: 0.99760

Traverse Point	Run Time 5.0 min/read	Pitot ΔP_s (in. H_2O)	Sample ΔH (in. H_2O)	Metered (dcf)	Stack T_s (°F)	Dry Gas Meter $T_{m\text{-}in}$ (°F)	Dry Gas Meter $T_{m\text{-}out}$ (°F)	$\sqrt{\Delta P_s}$ (calculated) ($\sqrt{}$in. H_2O)	Volume (calculated) (ft^3)	Isokinetics (calculated) (%)
	0.0			386.035						
5-01	5.0	0.44	1.10	389.030	283	95	94	0.66	2.99	98.9
5-02	10.0	0.47	1.10	391.987	286	98	94	0.69	2.96	94.4
5-03	15.0	0.50	1.20	395.100	286	100	95	0.71	3.11	96.1
5-04	20.0	0.45	1.10	398.130	286	102	95	0.67	3.03	98.4
5-05	25.0	0.37	0.90	400.800	285	103	96	0.61	2.67	95.4
LEAK CHECK	25.0			400.840						
4-01	30.0	0.48	1.20	403.970	284	101	96	0.69	3.13	98.3
4-02	35.0	0.50	1.20	407.090	285	103	96	0.71	3.12	95.9
4-03	40.0	0.45	1.10	410.090	285	104	96	0.67	3.00	97.1
4-04	45.0	0.41	0.99	412.910	285	104	96	0.64	2.82	95.6
4-05	50.0	0.42	1.00	415.750	286	104	96	0.65	2.84	95.2
LEAK CHECK	50.0			415.800						
3-01	55.0	0.36	0.87	418.430	283	102	97	0.60	2.63	95.1
3-02	60.0	0.42	1.00	421.260	286	103	97	0.65	2.83	94.9
3-03	65.0	0.41	1.00	424.050	286	104	97	0.64	2.79	94.6
3-04	70.0	0.48	1.20	427.230	287	105	97	0.69	3.18	99.7
3-05	75.0	0.40	1.00	430.055	288	106	98	0.63	2.82	96.8
LEAK CHECK	75.0			430.115						
2-01	80.0	0.60	1.50	433.550	286	104	98	0.77	3.44	96.3
2-02	85.0	0.50	1.30	436.840	286	106	98	0.71	3.29	100.8
2-03	90.0	0.49	1.30	440.130	286	106	98	0.70	3.29	101.8
2-04	95.0	0.42	1.10	443.160	287	106	98	0.65	3.03	101.3
2-05	100.0	0.44	1.10	446.160	284	106	98	0.66	3.00	97.8
LEAK CHECK	100.0			446.215						
1-01	105.0	0.40	1.00	449.040	282	104	98	0.63	2.83	96.6
1-02	110.0	0.42	1.10	452.030	288	104	98	0.65	2.99	100.2
1-03	115.0	0.45	1.10	455.020	286	105	98	0.67	2.99	96.6
1-04	120.0	0.42	1.10	458.000	286	105	98	0.65	2.98	99.7
1-05	125.0	0.44	1.10	460.990	286	105	98	0.66	2.99	97.7
Final	125.0		1.10640	74.75000	285.52000	100.10000		0.66655	74.75000	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.6665	1.1064	74.7500	285.5200	100.1000				
		☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

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USEPA Method 3 Laboratory Data

Test Method: USEPA Method 29
Analyte: Trace Metals

Location: Unit 3 FF Outlet
Client: Wheelabrator North Broward, Inc.
Project No: 12218
Method: EPA Method 3
Fuel Type: Municipal Waste
F_o for Fuel: 1.03 to 1.3

Analyst: P. Bihun
Analyst Emp No: 505

Run Number	Trial	Percent CO_2	Percent O_2+CO_2	Percent O_2	Percent N_2	Dry Mol. Weight	F_o	Method of Analysis: Orsat
1	1	9.8	19.0	9.2	81.0	29.94		
	2	9.8	18.8	9.0	81.2	29.93		
	3	9.8	19.0	9.2	81.0	29.94		
	Avg.	9.80000		9.13333	81.06667	29.93	1.20068	*All measurements in spec.*
CEM or Other Avg:								☑ Fo value within expected range.

Run Number	Trial	Percent CO_2	Percent O_2+CO_2	Percent O_2	Percent N_2	Dry Mol. Weight	F_o	Method of Analysis: Orsat
2	1	10.2	19.4	9.2	80.6	30.00		
	2	10.1	19.3	9.2	80.7	29.98		
	3	10.1	19.4	9.3	80.6	29.99		
	Avg.	10.13333		9.23333	80.63333	29.99	1.15132	*All measurements in spec.*
CEM or Other Avg:								☑ Fo value within expected range.

Run Number	Trial	Percent CO_2	Percent O_2+CO_2	Percent O_2	Percent N_2	Dry Mol. Weight	F_o	Method of Analysis: Orsat
3	1	9.4	18.8	9.4	81.2	29.88		
	2	9.4	18.8	9.4	81.2	29.88		
	3	9.4	18.8	9.4	81.2	29.88		
	Avg.	9.40000		9.40000	81.20000	29.88	1.22340	*All measurements in spec.*
CEM or Other Avg:								☑ Fo value within expected range.

Run Number	Trial	Percent CO_2	Percent O_2+CO_2	Percent O_2	Percent N_2	Dry Mol. Weight	F_o	Method of Analysis: Orsat
4	1	9.6	18.8	9.2	81.2	29.90		
	2	9.6	18.8	9.2	81.2	29.90		
	3	9.8	18.8	9.0	81.2	29.93		
	Avg.	9.66667		9.13333	81.20000	29.91	1.21724	*All measurements in spec.*
CEM or Other Avg:								☑ Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: Unit 3 FF Outlet
Client: Wheelabrator North Broward, Inc.
Project No: 12218

Test Method: USEPA Method 29
Analyte: Trace Metals
Analyst: R. Vicere
Analyst Emp No: 563

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	820.1	442.5	377.6
Impinger 2	5%HNO3/10%H2O2	702.7	542.8	159.9
Impinger 3	5%HNO3/10%H2O2	596.2	564.2	32.0
Impinger 4	Empty	456.0	447.7	8.3
Impinger 5	4%KMnO4/10%H2SO4	636.1	630.9	5.2
Impinger 6	4%KMnO4/10%H2SO4	554.6	554.0	0.6
Impinger 7	Silica Gel	784.7	765.5	19.2
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
583.6	Liquid (gm)		
0.0	less rinse (gm)		
583.6	Net Liquid (gm)	583.6	☑ QA/QC OK
+ 19.2	Silica Gel (gm)	19.2	☑ QA/QC OK
602.8	Total Vlc (gm)	602.8	☑ QA/QC OK

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	797.1	435.0	362.1
Impinger 2	5%HNO3/10%H2O2	701.8	548.9	152.9
Impinger 3	5%HNO3/10%H2O2	565.8	531.6	34.2
Impinger 4	Empty	432.1	424.8	7.3
Impinger 5	4%KMnO4/10%H2SO4	547.2	541.6	5.6
Impinger 6	4%KMnO4/10%H2SO4	541.4	541.1	0.3
Impinger 7	Silica Gel	765.9	747.4	18.5
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
562.4	Liquid (gm)		
0.0	less rinse (gm)		
562.4	Net Liquid (gm)	562.4	☑ QA/QC OK
+ 18.5	Silica Gel (gm)	18.5	☑ QA/QC OK
580.9	Total Vlc (gm)	580.9	☑ QA/QC OK

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	786.2	445.4	340.8
Impinger 2	5%HNO3/10%H2O2	672.4	547.2	125.2
Impinger 3	5%HNO3/10%H2O2	587.9	569.1	18.8
Impinger 4	Empty	453.6	449.2	4.4
Impinger 5	4%KMnO4/10%H2SO4	637.0	633.8	3.2
Impinger 6	4%KMnO4/10%H2SO4	560.3	559.5	0.8
Impinger 7	Silica Gel	797.5	783.8	13.7
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
493.2	Liquid (gm)		
0.0	less rinse (gm)		
493.2	Net Liquid (gm)	493.2	☑ QA/QC OK
+ 13.7	Silica Gel (gm)	13.7	☑ QA/QC OK
506.9	Total Vlc (gm)	506.9	☑ QA/QC OK

Test Run: 4

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	774.4	436.9	337.5
Impinger 2	5%HNO3/10%H2O2	667.3	552.0	115.3
Impinger 3	5%HNO3/10%H2O2	554.2	530.9	23.3
Impinger 4	Empty	430.9	426.8	4.1
Impinger 5	4%KMnO4/10%H2SO4	550.3	546.1	4.2
Impinger 6	4%KMnO4/10%H2SO4	542.7	542.0	0.7
Impinger 7	Silica Gel	780.9	765.5	15.4
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
485.1	Liquid (gm)		
0.0	less rinse (gm)		
485.1	Net Liquid (gm)	485.1	☑ QA/QC OK
+ 15.4	Silica Gel (gm)	15.4	☑ QA/QC OK
500.5	Total Vlc (gm)	500.5	☑ QA/QC OK

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LABORATORY DATA

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I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

CleanAir.

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Wheelabrator North Broward, Inc.
Clean Air Project No: 12218
Unit 3 FF Outlet

USEPA Method 29 (Trace Metals)
Mercury (Hg) Laboratory Parameters

Detection Limits		
$m_{1b\text{-}DL}$	Fraction 1B Detection Limit (µg)	0.1000
$m_{2b\text{-}DL}$	Fraction 2B Detection Limit (µg)	0.2000
$m_{3a\text{-}DL}$	Fraction 3A Detection Limit (µg)	0.2000
$m_{3b\text{-}DL}$	Fraction 3B Detection Limit (µg)	0.5000
$m_{3c\text{-}DL}$	Fraction 3C Detection Limit (µg)	0.4000
Blank Analysis		
$m_{1b\text{-}B}$	Fraction 1B Blank (µg)	<0.1000
$m_{2b\text{-}B}$	Fraction 2B Blank (µg)	<0.2000
$m_{3a\text{-}B}$	Fraction 3A Blank (µg)	<0.2000
$m_{3b\text{-}B}$	Fraction 3B Blank (µg)	<0.5000
$m_{3c\text{-}B}$	Fraction 3C Blank (µg)	<0.4000
$m_{total\text{-}B}$	Total Blank Amount (µg)	<1.4000

Run No.		**1**	**2**	**3**	**4**
Date (2013)		Jun 4	Jun 5	Jun 5	Jun 5
Start Time (approx.)		11:51	07:32	10:02	12:30
Stop Time (approx.)		14:03	09:44	12:13	14:42
Sample Analysis					
$m_{1b\text{-}S}$	Fraction 1B Sample (µg)	<0.1000	<0.1000	<0.1000	<0.1000
$m_{2b\text{-}S}$	Fraction 2B Sample (µg)	13.1804	10.4849	10.1246	12.4097
$m_{3a\text{-}S}$	Fraction 3A Sample (µg)	<0.2000	<0.2000	<0.2000	<0.2000
$m_{3b\text{-}S}$	Fraction 3B Sample (µg)	<0.5000	<0.5000	<0.5000	<0.5000
$m_{3c\text{-}S}$	Fraction 3C Sample (µg)	<0.4000	<0.4000	<0.4000	<0.4000
$m_{total\text{-}S}$	Total Sample Amount (µg)	13.1804	10.4849	10.1246	12.4097
Allowable Blank					
$m_{T\text{-}B\text{-}allow}$	Total Allowable Blank (µg)	0.0000	0.0000	0.0000	0.0000
Sample Corrected for Blank					
m_n	Total Sample Amount (µg)	13.1804	10.4849	10.1246	12.4097
Sample Corrected for Blank - Prorated Fractions					
$m_{n\text{-}1b}$	Fraction 1B (µg)	<0.1000	<0.1000	<0.1000	<0.1000
$m_{n\text{-}2b}$	Fraction 2B (µg)	13.1804	10.4849	10.1246	12.4097
$m_{n\text{-}3a}$	Fraction 3A (µg)	<0.2000	<0.2000	<0.2000	<0.2000
$m_{n\text{-}3b}$	Fraction 3B (µg)	<0.5000	<0.5000	<0.5000	<0.5000
$m_{n\text{-}3c}$	Fraction 3C (µg)	<0.4000	<0.4000	<0.4000	<0.4000

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Clean Air Engineering, Inc.

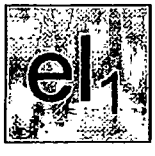
500 West Wood Street
Palatine, IL 60067

Project Number: 12218

Mercury

EPA Method 29 Analysis

Analytical Report
20590



Element One, Inc.
6319-D Carolina Beach Rd., Wilmington, NC 28412
910-793-0128 FAX: 910-792-6853 e1lab@e1lab.com

The following data for Analytical Report 20590
has been reviewed for completeness, accuracy,
adherence to method protocol,
and compliance with quality assurance guidelines.

Review by:

Daphne Woodman, Chemist
June 21, 2013

Report Reviewed and Finalized By:

Ken Smith, Laboratory Director
June 21, 2013

SUMMARY OF RESULTS

Summary of Analysis

Summary of Method 29 Mercury Analysis

Run Number		Average Total Catch, µg	Front Half µg	H_2O_2 /HNO_3 µg	Empty Impinger µg	$KMnO_4$ µg	HCl µg
Unit 3 R1	#1	13.2	< 0.1	13.2	< 0.2	< 0.5	< 0.4
	#2		< 0.1	13.2	< 0.2	< 0.5	< 0.4
Unit 3 R2	#1	10.5	< 0.1	10.4	< 0.2	< 0.5	< 0.4
	#2		< 0.1	10.6	< 0.2	< 0.5	< 0.4
Unit 3 R3	#1	10.1	< 0.1	10.1	< 0.2	< 0.5	< 0.4
	#2		< 0.1	10.1	< 0.2	< 0.5	< 0.4
Unit 3 R4	#1	12.4	< 0.1	12.3	< 0.2	< 0.5	< 0.4
	#2		< 0.1	12.5	< 0.2	< 0.5	< 0.4
Field Blank	#1	< 0.5	< 0.1	< 0.3	< 0.2	< 0.5	< 0.4
	#2		< 0.1	< 0.3	< 0.2	< 0.5	< 0.4
Reagent Blank	#1	< 0.5	< 0.1	< 0.2	< 0.2	< 0.5	< 0.4
	#2		< 0.1	< 0.2	< 0.2	< 0.5	< 0.4

ANALYTICAL NARRATIVE

Element One Analytical Narrative

Client:	Clean Air, IL	Element One #:	20590
Client ID:	12218 Wheelabrator Pompano Beach, FL	Analyst:	LAL & JWL
Method:	Method 29	Dates Received:	06/06/13
Analytes:	Hg	Dates Analyzed:	06/11-17/13

Summary of Analysis

The Method 29 samples were digested, prepared, and analyzed according to Method 29 protocol. Samples were analyzed for mercury on a PerkinElmer FIMS-100 CVAA mercury analyzer.

Detection Limits

The FIMS-100 CVAA instrument reporting limit for mercury was 0.004 µg per aliquot analyzed.

Analysis QA/QC

Duplicate analyses relative percent difference (RPD) and spike sample recovery data are summarized in the Quality Control Section. All 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.

QUALITY CONTROL SUMMARY

Summary of Quality Control Data

Mercury Duplicate Analysis RPD

(Method 29 QC limits: < 10% for RPD)

Run Number	Front Half	H_2O_2/HNO_3	Empty Imp	$KMnO_4$	HCl
Unit 3 R1	NA	0.3%	NA	NA	NA
Unit 3 R2	NA	1.8%	NA	NA	NA
Unit 3 R3	NA	0.0%	NA	NA	NA
Unit 3 R4	NA	1.5%	NA	NA	NA
Field Blank	NA	NA	NA	NA	NA
Reagent Blank	NA	NA	NA	NA	NA

Mercury Spike Recoveries

(Method 29 QC limits: ± 25% for Spike Recoveries)

Run Number		Front Half	H_2O_2/HNO_3	Empty Imp	$KMnO_4$	HCl
Unit 3 R3	#1	104%	87%	93%	91%	107%
	#2	104%	86%	92%	92%	107%

SAMPLE CUSTODY

20590

CLIENT	Wheelabrator	PROJECT	12218
PLANT	Pompano Beach, FL	DEPT.	66
PROJECT MANAGER	S. Brown		

66-12218-11

ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION
USEPA M-29	1	QUARTZ FILTER 250 mL HDPE

CleanAir Engineering
500 West Wood Street
Palatine, IL 60067
800-627-0833 (phone)
847-991-9385 (fax)

LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?	ANALYSIS REQUESTED: Mercury	ANALYSIS REQUESTED: Archive	ADDITIONAL INFORMATION
	6/4	Unit 3	1	Quartz Filter, 250 mL HDPE	1	X	X		
	6/5	Unit 3	2	Quartz Filter, 250 mL HDPE	1	X	X		
	6/5	Unit 3	3	Quartz Filter, 250 mL HDPE	1	X	X		
	6/5	Unit 3	4	Quartz Filter, 250 mL HDPE	1	X	X		
	6/5	Unit 3	Field Blank	Quartz Filter, 250 mL HDPE	1	X	X		

FORWARDING LAB
Element One, Inc.
8319C Carolina Beach Rd
Wilmington, NC 28412
910-793-0128 (phone)
Ken Smith

Report Front and Back Half Seperately

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	This form completed by:
R. Vicere	6-6-13 @17:00					R. Vicere 6/5/13
Received By: (signature)	**Date / Time**	**Received By: (signature)**	**Date / Time**	**Relinquished By: (signature)**	**Date / Time**	**Signature / Date**
	6/6/13 1030					

Samples received in good condition in Fisherbrand + QEC Level 2 containers. No empty container received.

20590

66-12218-12

CLIENT: Wheelabrator
PLANT: Pompano Beach, FL
PROJECT MANAGER: S. Brown
PROJECT: 12218
DEPT.: 66

CleanAir Engineering
500 West Wood Street
Palatine, IL 60067
800-627-0033 (phone)
847-991-3395 (fax)

ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION
USEPA M-29	3	FRONT HALF HNO_3 RINSE 250 mL HDPE

LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?	ANALYSIS REQUESTED:		Mercury	Archive	ADDITIONAL INFORMATION
	6/4	Unit 3	Train Prep	Front Half HNO_3 Rinse, 250 mL HDPE	*	X				X	
	6/4	Unit 3	1	Front Half HNO_3 Rinse, 250 mL HDPE	1	X		X			
	6/5	Unit 3	2	Front Half HNO_3 Rinse, 250 mL HDPE	1	X		X			
	6/5	Unit 3	3	Front Half HNO_3 Rinse, 250 mL HDPE	1	X		X			
	6/5	Unit 3	4	Front Half HNO_3 Rinse, 250 mL HDPE	1	X		X			
	6/5	Unit 3	Field Blank	Front Half HNO_3 Rinse, 250 mL HDPE	1	X		X			
											Report Front and Back Half
											Separately

FORWARDING LAB
Element Ons, inc
6316C Carolina Beach Rd
Wilmington, NC 28412
910 793-0128 (phone)
Ken Smith

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time
R Vicere	6-5-13 @17:00				
Received By: (signature)	**Date / Time**	**Received By: (signature)**	**Date / Time**	**Relinquished By: (signature)**	**Date / Time**
Lisa Bratton	6/6/13 1030				

This form completed by:
R. Vicere 6/5/13
Signature Date

20590

CLIENT	Wheelabrator	PROJECT	12218
PLANT	Pompano Beach, FL	DEPT.	66
PROJECT MANAGER	S. Brown		

ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION
USEPA M-29	4	IMPINGERS 1-3 CATCH AND RINSE 1000 mL HDPE

CleanAir ENGINEERING
800 West Wood Street
Palatine, IL 60067
800-627-0033 (phone)
847-991-0385 (fax)

66-12218-13

LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?	ANALYSIS REQUESTED: Mercury	ANALYSIS REQUESTED: Archive	ADDITIONAL INFORMATION
	6/4	Unit 3	1	Impingers 1-3 Catch and Rinse, 1000 mL HDPE	1	X	X		
	6/5	Unit 3	2	Impingers 1-3 Catch and Rinse, 1000 mL HDPE	1	X	X		
	6/5	Unit 3	3	Impingers 1-3 Catch and Rinse, 1000 mL HDPE	1	X	X		
	6/5	Unit 3	4	Impingers 1-3 Catch and Rinse, 1000 mL HDPE	1	X	X		
	6/5	Unit 3	Field Blank	Impingers 1-3 Catch and Rinse, 1000 mL HDPE	1	X	X		

FORWARDING LAB
Element One, Inc.
6519C Carolina Beach Rd
Wilmington NC 28412
910-793-0126 (phone)
Ken Smith

Report Front and Back Hg Separately

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	This form completed by:
R. Vicere	6-5-13 @17:00					R. Vicere 6/5/13
Received By: (signature)	**Date / Time**	**Received By: (signature)**	**Date / Time**	**Relinquished By: (signature)**	**Date / Time**	**Signature / Date**
Lea Brinton	6/6/13 1030					

20590

CLIENT Wheelabrator
PLANT Pompano Beach, FL
PROJECT MANAGER S. Brown

PROJECT 12218
DEPT. 66

66-12218-14

ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION
USEPA M-29	5A	IMPINGER 4 CATCH AND RINSE 250 mL HDPE

CleanAir Engineering
309 West Wood Street
Palatine, IL 60067
800-627-0033 (phone)
847-991 3365 (fax)

LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?	ANALYSIS REQUESTED: Mercury	ANALYSIS REQUESTED: Archive	ADDITIONAL INFORMATION
	6/4	Unit 3	1	Impinger 4 Catch and Rinse, 250 mL HDPE	1	X	X		
	6/5	Unit 3	2	Impinger 4 Catch and Rinse, 250 mL HDPE	1	X	X		
	6/5	Unit 3	3	Impinger 4 Catch and Rinse, 250 mL HDPE	1	X	X		
	6/5	Unit 3	4	Impinger 4 Catch and Rinse, 250 mL HDPE	1	X	X		
	6/5	Unit 3	Field Blank	Impinger 4 Catch and Rinse, 250 mL HDPE	1	X	X		

FORWARDING LAB
Element One, Inc
6319C Carolina Beach Rd
Wilmington, NC 28412
910-799-0129 (phone)
Ken Smith

Report From and Back Half Separately

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time
R. Vicere	6-5-13 @ 17:00				
Received By: (signature)	**Date / Time**	**Received By: (signature)**	**Date / Time**	**Relinquished By: (signature)**	**Date / Time**
Lisa Bruton	6/6/13 1030				

This form completed by:
R. Vicere 6/6/13
Signature Date

20590

CLIENT: Wheelabrator				PROJECT: 12218								66-12218-15	
PLANT: Pompano Beach, FL				DEPT.: 66									
PROJECT MANAGER: S. Brown				CleanAir 500 West Wood Street Palatine, IL 60067 630-627-0035 (phone) 847-991-3385 (fax)									
ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION											
USEPA M-29	SS	IMPINGERS 5-6 CATCH AND RINSE 950 mL AMBER GLASS											
LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?	ANALYSIS REQUESTED					FORWARDING LAB	
								Mercury		Archive		Element One, Inc 5319C Carolina Beach Rd Wilmington, NC 28412 910-793-0128 (phone) Ken Smith	
	6/4	Unit 3	1	Impingers 5-6 Catch and Rinse, 950 mL Amber Glass	1	X		X				ADDITIONAL INFORMATION	
	6/5	Unit 3	2	Impingers 5-6 Catch and Rinse, 950 mL Amber Glass	1	X		X					
	6/5	Unit 3	3	Impingers 5-6 Catch and Rinse, 950 mL Amber Glass	1	X		X					
	6/5	Unit 3	4	Impingers 5-6 Catch and Rinse, 950 mL Amber Glass	1	X		X					
	6/5	Unit 3	Field Blank	Impingers 5-6 Catch and Rinse, 950 mL Amber Glass	1	X		X					
												Report Front and Back Half	
												Separately	

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	This form completed by:
R. Vicere	6-5-13 @17:00					R. Vicere 6/6/13
Received By: (signature)	**Date / Time**	**Received By: (signature)**	**Date / Time**	**Relinquished By: (signature)**	**Date / Time**	**Signature / Date**
Lisa Bratton	6/6/13 1030					

20590

CLIENT: Wheelabrator
PLANT: Pompano Beach, FL
PROJECT MANAGER: S. Brown
PROJECT: 12218
DEPT: 66

CleanAir
500 West Wood Street
Palatine, IL 60067
800-627-0093 (phone)
847-991-3395 (fax)

66-12218-15

ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION
USEPA M-29	6	IMPINGERS 5-6 CATCH AND RINSE 250 mL AMBER GLASS

FORWARDING LAB
Element One, Inc
8319C Carolina Beach Rd
Wilmington, NC 28412
910-793-0120 (phone)
Ken Smith

LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?	ANALYSIS REQUESTED			ADDITIONAL INFORMATION
								Mercury	Archive	
	6/4	Unit 3	1	Impinger 5-6 8N HCl + DI Water, Container 250 mL Amber Glass	1	X	X			
	6/5	Unit 3	2	Impinger 5-6 8N HCl + DI Water, Container 250 mL Amber Glass	1	X	X			
	6/5	Unit 3	3	Impinger 5-6 8N HCl + DI Water Container, 250 mL Amber Glass	1	X	X			
	6/5	Unit 3	4	Impinger 5-6 8N HCl + DI Water Container 250 mL Amber Glass	1	X	X			
	6/5	Unit 3	Field Blank	Impinger 5-6 8N HCl + DI Water, Container, 250 mL Amber Glass	1	X	X			
										Report Front and Back Half
										Seperately

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	This form completed by:
R. Vicere	6-5-13 @17:00					R. Vicere 6/5/13
Received By: (signature)	Date / Time	Received By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Signature Date
Lisa Bratton	6/6/13 1030					

20590

CLIENT: Wheelabrator				PROJECT: 12218							68-12218-17	
PLANT: Pompano Beach, FL				DEPT.: 66								
PROJECT MANAGER: S. Brown				CleanAir. 500 West Wood Street Palatine, IL 60067 800-527-0033 (phone) 847-991-3395 (fax)								
ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION										
USEPA M-29	SEE BELOW (IF APPLICABLE)	REAGENT BLANKS										
LAB ID NUMBER	DATE (2013)	TEST LOCATION	RUN NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	CONTAINER SEALED? LIQUID LEVEL MARKED?						
	6/4	Reagent Blank	All	0.1 N HNO_3 (350 mL). Container 8A: 500 mL HDPE	1	X		X				
	6/4	Reagent Blank	All	DI Water (100 mL). Container 8B: 250 mL HDPE	1	X		X				
	6/4	Reagent Blank	All	5% HNO_3 / 10% H_2O_2 (200 mL). Container 9: 250 mL HDPE	1	X		X				
	6/4	Reagent Blank	All	4% $KMnO_4$ / 10% H_2SO_4 (100 mL). Container 10: 250 mL Amber Glass	1	X		X				
	6/4	Reagent Blank	All	DI Water (200 mL) / 8N HCl (25 mL). Container 11: 250 mL Amber Glass	1	X		X				
	6/4	Reagent Blank	All	Quartz Filters (3). Container 12: 250 mL HDPE	1	X		X				

ANALYSIS REQUESTED: Mercury; Archive

FORWARDING LAB: Element One, Inc. 65190 Carolina Beach Rd Wilmington, NC 28412 910-793-0125 (phone) Ken Smith

ADDITIONAL INFORMATION

Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	Relinquished By: (signature)	Date / Time	This form completed by:
R. Vicere	6-5-13 @17:00					R. Vicere 6/5/13
Received By: (signature)	**Date / Time**	**Received By: (signature)**	**Date / Time**	**Relinquished By: (signature)**	**Date / Time**	**Signature / Date**
Lea Braton	6/6/13 1030					

ANALYTICAL DATA

Analytical Calculations

Mercury-

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

Where-

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

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

Final Volume=Final Volume (FV)*--*Sample Submission*
* With the exception of the BH fraction where-
=Received Volume (BV)--*Sample Submission*

Analytical Calculations

Spike Recovery-

$$\textbf{Spike (\%)} = \frac{\textbf{(Spiked Result (µg/L) – Sample Result (µg/L))}}{\textbf{Spike Amount (µg/L)}} \textbf{ X100}$$

Where-

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

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

Spike Amount--*ICP-MS Spike Table*

Duplicate Analysis RPD-

$$\textbf{RPD (\%)} = \frac{\textbf{(Duplicate Result (µg/L) - Sample Result (µg/L))}}{\textbf{Average (µg/L)}} \textbf{ X100}$$

Where-

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

Duplicate Results=Raw sample concentration (ppb)--*ICP-Data Sheet*

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

elementOne **AIR TESTING SAMPLE SUBMISSION FORM** **Lab ID 20590**

Analysis Due Date 06.14.13
QA/QC/Report Due Date 06.18.13

Client	Clean Air IL
Project No	12218

Date Rec	06.06.13
Time Rec	1030

HNO_3 Lot: K50030	HF Lot: 5112070	HCl Lot: 4112070	**Ref. Method: 29**
Volume Marked Y / N	Volume Loss Y / N		

Sample Identification

1	U3-M29-R1	5	Field Blank		
2	U3-M29-R2	6	Reagent Blank		
	U3-M29-R2 Duplicate				
3	U3-M29-R3				
	U3-M29-R3 Spike				
4	U3-M29-R4				

Analyses Requested Samples 1-6 Hg

Runs / FB	Fil / Ace (FH) pH <2.0 Y / N		HNO_3 (FH) pH <2.0 Y N		5% HNO_3/10% H_2O_2 (BH) pH <2.0 Y N			HNO_3 (A) pH <2.0 Y / N		$KMnO_4$ (B) pH <2.0 Y N		HCl (C) pH <2.0 Y N	
Lab ID	Fil ID	BV ml	BV ml	FV ml	BV ml	Used	FV ml	BV ml	FV ml	BV ml	FV ml	BV ml	FV ml
1			210	100	860			104	200	380	500	230	400
2.D			160		~~240~~ 840			108		380		230	
3.S			165		790			106		390		220	
4			140		775			110		390		220	
6			115		300			104		400		230	

M-29 Reagent Blank

Lab ID	Fraction			BV, ml	FV, ml	Comments
6	C-7	FH	Acetone Blank			
	C-8A	FH	0.1N HNO_3	300	100	used 100 mL
	C-8A	A	0.1N HNO_3	300	-	
	C-8B	B	DI H_2O	208	100/33	
	C-9	BH	5% HNO_3/10% H_2O_2	200		
	C-10	B	4% $KMnO_4$/10%H_2SO_4	190	100/33	used 100 mL $KMnO_4$, 33 mL of DI
	C-11	C	8N HCl DI H_2O	230	400	
	C-12	FH	Filter			

Lab Communications

LRB FH ↑, Filter ↑ spiked w/ 100uL of Std A

M29: Received C1, C3, C4; C5A, C5B, C5C; RB C12, C8A, C8B, C9, C10, C11— Archive Train Proof —06.06.13 LLB

SS Page 1 of 1
6/7/2013 10:59:19 AM
SS by XRG
Labeled By/Date SWL 6.7.13

FH Prep By/Date LAL 6.3.13 A Prep By/Date SWL 6.7.13
BH Prep By/Date SWL 6.7.13 B Prep By/Date LAL 6.10.13
BH/FH Prep By/Date — C Prep By/Date SWL 6.11.13
PM Prep By / Date — ID Verification By/Date SRB 6.7.13

elementOne **Method 29 Microwave Worksheet** Lab ID # e 20590

Client: CAE

Date Digested: 6-13-13 Initials: JWL Worksheet Prepared by: JWL

Auto Sample Loc.	Sample Lab ID	Sample Weight (g)	# of filters digested	Spike	Prep Volume (ml)	Weight In Micro / Weight Out Micro	Units
	CRB				100		
	CRB+			100 uL Std A			
	-1		1				
	-2						
	-3						
	-4						
	-5						
	-6						

CRB+ spiked w/ 100 uL of Std A @ 25ppm

Element One, Inc. Form 104 - Revision 1.0

HF Lot # 511207D (2 mL)

HNO_3 Lot # K56030 (and)

elementOne **MERCURY BATCH DIGESTION - RUN WORKSHEET**

Block #3 92.40

Date Prepared/Digested: 6-10-13 Prep By: LAL SIF File #: 061113-1

Block #1 Temperature: 95.13 Start Time: 5:55 Machine ID: #1

Block #2 Temperature: 94.99 Stop Time: 8:10 Batch Analyst: JWL / LAL

A/S	Curve & QC's	0.4ug/ml working std		BV, ml	FV, ml	Standard Lot Numbers
1	Lab BLK (3/ batch)	0		40	40	Standard #1 (for working std) Lot #: 4205419
2	0.004 ug	0.01ml		40	40	Working Standard
3	0.04 ug	0.10ml		40	40	Lot #: 061013-1 by: LAL
4	0.08 ug	0.20ml		40	40	Standard #2 (QC #2):
5	0.16 ug	0.40ml		40	40	Lot #: 061013-2
6	0.20ug	0.50ml		40	40	Standard #3 (QC #3):
						Lot #: 061013-3
7	QC #2= 0.08ug	0.2ml #2 std		40	40	
8	QC #3= 0.08ug	0.2ml #3 std		40	40	Curve prepared by: LAL

Submitted for Review By: Date: Time:

Initial Review By: LAL / JWL Date: 6-11-13 Time: 1:15

Final QC Review By: [illegible] Date: 6.11.13 Time: 1446

Comments: 20531-6 H+P Stock = 4ml 20587-1 + @ 1ml

A/S	LAB #	Client	Wt/FV	Ali Used	ml used	Sample Vol. ml	Spike µg
9	20529-6BH				4	790	
10	-6BHD				↓	↓	
11	20533-3				10	1	
12	-3+				↓	↓	
13	20588-3				5	↓	
14	-3+				↓	↓	
15	20534-3				10	↓	
16	-3+				↓	↓	
17	-3				5	↓	
18	-3+				↓	↓	
19	20587-1				10	↓	

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 0.20ml per 40ml sample.

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

H_2SO_4 @ 2.0ml..... HNO_3 @ 1.0ml..... Persulfate @ 3.0ml..... $KMnO_4$ @ 6.0ml

H_2SO_4 Lot # 51144 HNO_3 Lot # K50030 HCl Lot #: 4112070

Persulfate Lot # 060713-5 $KMnO_4$ Lot # 052913-4 Hydrox Lot#: 060713-3

Clear samples after digestion with 3.2ml of Hydroxylamine solution.

Element One, Inc form 128-Revision 7.0 Page 1 of 4

elementOne **MERCURY BATCH DIGESTION - RUN WORKSHEET**

SIF File #: _____

A/S	LAB #	Client	Wt/FV	Ali Used	ml used	Sample Vol. ml	Spike µg
90	20531-7BH				4	200	
91	20590-1BH				4	860	
92	-2BH					840	
93	-2BHD					↓	
94	-3BH					790	
95	-3BHT					↓	
96	-4BH					775	
97	-5BH					300	
98	-6BHS					200	
99	20590-1A					200	
100	-2A						
101	-2AD						
102	-3A						
103	-3AT						
104	-4A						
105	-5A						
106	-6A				↓	↓	

elementOne **MERCURY BATCH DIGESTION - RUN WORKSHEET**

Date Prepared/Digested: 6-13-13 13 Prep By: LAL/JWL SIF File #: 061413-2
Block #1 Temperature: 93.39 Start Time: 8:00 Machine ID: #1
Block #2 Temperature: 91.96 Stop Time: 10:15 Batch Analyst: JWL/LAL
Block #3 Temperature: 91.68

A/S	Curve & QC's	0.4ug/ml working std		BV, ml	FV, ml	Standard Lot Numbers
						Standard #1 (for working std)
1	Lab BLK (3/batch)	0		40	40	Lot #: 4205419
2	0.004 ug	0.01ml		40	40	Working Standard
3	0.04 ug	0.10ml		40	40	Lot #: 061013-1 by: LAL
4	0.08 ug	0.20ml		40	40	Standard #2 (QC #2):
5	0.16 ug	0.40ml		40	40	Lot #: 061013-2
6	0.20ug	0.50ml		40	40	Standard #3 (QC #3):
						Lot #: 061013-3
7	QC #2= 0.08ug	0.2ml #2 std		40	40	
8	QC #3= 0.08ug	0.2ml #3 std		40	40	Curve prepared by: JWL

Initial Review By: JWL/LAL Date: 6.14.13 Time: 2:00
Final QC Review By: DBL Date: 6/14/13 Time: 1508
Comments: 20597-5CD@4mL 2059D-LRBFH+@1.6mL

A/S	LAB #	Client	Wt/FV	Ali Used	ml used	Sample Vol, ml	Spike µg
9	20600-1B				4	500	
10	-2B						
11	-2BD						
12	-3B						
13	-3BT						
14	-4B						
15	-5B						
16	-5BD						
17	-6B						
18	6BT						
19	-7B						

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 0.20ml per 40ml sample.

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

H_2SO_4 @ 2.0ml..... HNO_3 @ 1.0ml..... Persulfate @ 3.0ml..... $KMnO_4$ @ 6.0ml

H_2SO_4 Lot # 51144 HNO_3 Lot # K50030 HCl Lot #: 411020

Persulfate Lot # 060713-5 $KMnO_4$ Lot # 060713-4 Hydrox Lot#: 060713-3

Clear samples after digestion with 3.2ml of Hydroxylamine solution.

elementOne **MERCURY BATCH DIGESTION - RUN WORKSHEET**

SIF File #: _____

A/S	LAB #	Client	Wt/FV	All Used	ml used	Sample Vol, ml	Spike µg
55	20597 - 7BH				4	850	
56	- 8BH				↓	210	
57	20597 - 1C				4	400	
58	- 2C				↓	↓	
59	- 2CD						
60	- 3C						
61	- 3C +						
62	- 4C						
63	- 5C						
64	- 5CD				↓	↓	
65	20598 LRB FH				4	100	
66	LRB FH +				1.6	↓	
67	- 1FH				4		
68	- 2FH				↓		
69	- 2FHD						
70	- 3FH						
71	- 3FH +						
72	- 4FH						
73	- 5FH						
74	- 6FH				↓	↓	
75	19772 - 4QC				.025	5	
76	L/C QC				1	1	
77							
78							
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							

Element One, Inc form 128-Revision 8.0 Page 3 of 4

PerkinElmer FIMS-100 CVAA Mercury Analyzer

Sample_ID	Date	Time	Mean_Sig	Mean_Rd	Mean_Rt	Units	Alq.	Vol.	Sig 1	Reading-1	Result-1	Sig 2	Reading-2	Result-2
Calib Blank	6/11/2013	9:04:16	0.0001187			µg			0.0001187					
STD1=.004ug	6/11/2013	9:05:30	0.0012822			µg			0.0012822					
STD2=.04ug	6/11/2013	9:06:45	0.0122926			µg			0.0122926					
STD3=.08ug	6/11/2013	9:08:01	0.0238378			µg			0.0238378					
STD4=.16ug	6/11/2013	9:09:18	0.0482039			µg			0.0482039					
STD5=.2ug	6/11/2013	9:10:36	0.0594644			µg			0.0594644					
Reagent Blank	6/11/2013	9:26:46	0.0001957	0.0006547	0.0006547	µg			0.0002438	0.0008153	0.0008153	0.0001477	0.000494	0.000494
0.004ug = DL	6/11/2013	9:30:25	0.001245	0.0041639	0.0041639	µg			0.001245	0.0041639	0.0041639			
0.080ug = STD.2	6/11/2013	9:31:41	0.0224427	0.0750612	0.0750612	µg			0.0224427	0.0750612	0.0750612			
REAGENT BLANK	6/11/2013	9:32:57	0.0001364	0.0004563	0.0004563	µg			0.0001364	0.0004563	0.0004563			
0.080ug = STD.2	6/11/2013	9:34:13	0.0218825	0.0731875	0.0731875	µg			0.0218825	0.0731875	0.0731875			
0.080ug = QC STD 3	6/11/2013	9:35:32	0.0224219	0.0749916	0.0749916	µg			0.0224219	0.0749916	0.0749916			
REAGENT BLANK	6/11/2013	9:36:48	0.0001481	0.0004953	0.0004953	µg			0.0001481	0.0004953	0.0004953			
0.004ug = DL	6/11/2013	12:31:11	0.0012424	0.0041554	0.0041554	µg	4	1260	0.0012424	0.0041554	0.0041554			
0.080ug = STD.2	6/11/2013	12:32:27	0.0221796	0.0741812	0.0741812	µg	4	1260	0.0221796	0.0741812	0.0741812			
REAGENT BLANK	6/11/2013	12:33:44	0.0001156	0.0003867	0.0003867	µg	4	1260	0.0001156	0.0003867	0.0003867			
20590-1BH	6/11/2013	12:39:03	0.0183294	0.0613041	13.180388	µg	4	860	0.0183594	0.0614043	13.201933	0.0182995	0.0612039	13.158842
20590-2BH	6/11/2013	12:40:48	0.0149281	0.0499281	10.484911	µg	4	840	0.0147968	0.0494888	10.392646	0.0150595	0.0503675	10.577177
20590-2BH DUP	6/11/2013	12:42:29	0.015012	0.0502086	10.543806	µg	4	840	0.0147828	0.049442	10.382829	0.0152412	0.0509752	10.704784
20590-3BH	6/11/2013	12:44:11	0.0153274	0.0512637	10.124581	µg	4	790	0.0153259	0.0512584	10.123542	0.015329	0.051269	10.125619
20590-3BH SPK	6/11/2013	12:45:54	0.035992	0.1203779	23.774642	µg	4	790	0.0360777	0.1206645	23.83124	0.0359064	0.1200914	23.718043
20590-4BH	6/11/2013	12:47:37	0.0191505	0.06405	12.409693	µg	4	775	0.0190044	0.0635616	12.315054	0.0192965	0.0645385	12.504332
20590-5BH	6/11/2013	12:49:20	4.719E-05	0.0001578	0.0118382	µg	4	300	3.816E-05	0.0001276	0.009573	5.622E-05	0.000188	0.0141034
20590-6BH	6/11/2013	12:51:03	-0.0000209	-0.0000701	-0.0035096	µg	4	200	-0.0000476	-0.0001595	-0.0079766	5.72E-06	1.914E-05	0.0009574
0.004ug = DL	6/11/2013	12:52:16	0.0011914	0.0039846	0.0039846	µg	4	200	0.0011914	0.0039846	0.0039846			
0.080ug = STD.2	6/11/2013	12:53:32	0.0226737	0.0758337	0.0758337	µg	4	200	0.0226737	0.0758337	0.0758337			
REAGENT BLANK	6/11/2013	12:54:49	0.0001273	0.0004258	0.0004258	µg	4	200	0.0001273	0.0004258	0.0004258			
20590-1A	6/11/2013	12:56:33	7.251E-05	0.0002425	0.012127	µg	4	200	5.336E-05	0.0001785	0.0089244	9.166E-05	0.0003066	0.0153296
20590-2A	6/11/2013	12:58:19	3.691E-05	0.0001235	0.006174	µg	4	200	2.413E-05	8.071E-05	0.0040358	0.0000497	0.0001662	0.0083121
20590-2A DUP	6/11/2013	13:00:03	5.522E-05	0.0001847	0.0092349	µg	4	200	8.098E-05	0.0002709	0.0135435	2.945E-05	9.852E-05	0.0049263
20590-3A	6/11/2013	13:01:49	5.509E-05	0.0001843	0.0092135	µg	4	200	4.627E-05	0.0001548	0.0077388	6.391E-05	0.0002138	0.0106882
20590-3A SPK	6/11/2013	13:03:36	0.0220476	0.0737397	3.686987	µg	4	200	0.0221712	0.0741531	3.7076561	0.021924	0.0733264	3.6663179
20590-4A	6/11/2013	13:05:22	-0.000045	-0.0001505	-0.0075283	µg	4	200	-0.0000749	-0.0002506	-0.0125307	-0.0000151	-0.0000505	-0.0025259
20590-5A	6/11/2013	13:07:10	-0.000066	-0.0002208	-0.0110435	µg	4	200	-0.0000596	-0.0001993	-0.009968	-0.0000724	-0.0002423	-0.0121191
20590-6A	6/11/2013	13:08:58	-0.0000845	-0.0002828	-0.0141443	µg	4	200	-0.000088	-0.0002946	-0.0147327	-0.000081	-0.0002711	-0.0135559
0.004ug = DL	6/11/2013	13:10:13	0.001232	0.0041205	0.0041205	µg	4	200	0.001232	0.0041205	0.0041205			
0.080ug = QC STD 3	6/11/2013	13:11:28	0.0222555	0.0744352	0.0744352	µg	4	200	0.0222555	0.0744352	0.0744352			
REAGENT BLANK	6/11/2013	13:12:44	7.862E-05	0.000263	0.000263	µg	4	200	7.862E-05	0.000263	0.000263			
Calib Blank	6/12/2013	8:49:14	0.0001348			µg			0.0001348					
STD1=.004ug	6/12/2013	8:50:33	0.0012627			µg			0.0012627					
STD2=.04ug	6/12/2013	8:51:49	0.0126931			µg			0.0126931					
STD3=.08ug	6/12/2013	8:53:06	0.0245327			µg			0.0245327					
STD4=.16ug	6/12/2013	8:54:24	0.048864			µg			0.048864					
STD5=.2ug	6/12/2013	8:55:43	0.0604305			µg			0.0604305					
Reagent Blank	6/12/2013	8:57:31	3.185E-05	0.0001048	0.0001048	µg			5.128E-05	0.0001687	0.0001687	1.242E-05	4.085E-05	4.085E-05
0.004ug = DL	6/12/2013	8:58:45	0.0013304	0.004376	0.004376	µg			0.0013304	0.004376	0.004376			
0.080ug = STD.2	6/12/2013	9:00:02	0.0240027	0.0789485	0.0789485	µg			0.0240027	0.0789485	0.0789485			
0.080ug = QC STD 3	6/12/2013	9:01:22	0.024	0.0789397	0.0789397	µg			0.024	0.0789397	0.0789397			
REAGENT BLANK	6/12/2013	9:02:39	9.578E-05	0.000315	0.000315	µg			9.578E-05	0.000315	0.000315			
0.004ug = DL	6/12/2013	11:56:40	0.0013422	0.0044147	0.0044147	µg	4	100	0.0013422	0.0044147	0.0044147			
0.080ug = STD.2	6/12/2013	11:57:58	0.0230863	0.0759343	0.0759343	µg	4	100	0.0230863	0.0759343	0.0759343			
REAGENT BLANK	6/12/2013	11:59:15	8.404E-05	0.0002764	0.0002764	µg	4	100	8.404E-05	0.0002764	0.0002764			
20590-1B	6/12/2013	12:02:51	0.0001016	0.000334	0.0417541	µg	4	500	0.0001083	0.0003562	0.0445194	9.482E-05	0.0003119	0.0389887
20590-2B	6/12/2013	12:04:41	0.0001145	0.0003765	0.0470643	µg	4	500	0.0001244	0.0004091	0.0511355	0.0001046	0.0003439	0.0429931
20590-2B DUP	6/12/2013	12:06:28	0.0001275	0.0004193	0.0524079	µg	4	500	0.0001141	0.0003753	0.046916	0.0001408	0.0004632	0.0578997
20590-3B	6/12/2013	12:08:11	0.0001304	0.0004288	0.0536014	µg	4	500	0.0001352	0.0004447	0.0555818	0.0001256	0.000413	0.051621
20590-3B SPK	6/12/2013	12:09:55	0.0221839	0.0729663	9.1207844	µg	4	500	0.0220268	0.0724494	9.0561775	0.022341	0.0734831	9.1853913
20590-4B	6/12/2013	12:11:39	0.0001362	0.0004479	0.0559884	µg	4	500	0.0001382	0.0004547	0.0568358	0.0001341	0.0004411	0.0551411
20590-5B	6/12/2013	12:13:24	0.0001442	0.0004741	0.0592665	µg	4	500	0.0001532	0.000504	0.0629958	0.0001351	0.0004443	0.0555373
20590-6B	6/12/2013	12:15:10	3.818E-05	0.0001256	0.0156993	µg	4	500	3.796E-05	0.0001249	0.0156082	0.0000384	0.0001263	0.0157905
20590-1C	6/12/2013	12:16:56	0.0006911	0.0022731	0.2273133	µg	4	400	0.0006967	0.0022917	0.2291657	0.0006855	0.0022546	0.2254608
0.004ug = DL	6/12/2013	12:18:09	0.0012981	0.0042698	0.0042698	µg	4	400	0.0012981	0.0042698	0.0042698			
0.080ug = STD.2	6/12/2013	12:19:27	0.0233433	0.0767796	0.0767796	µg	4	400	0.0233433	0.0767796	0.0767796			
REAGENT BLANK	6/12/2013	12:20:44	0.0000791	0.0002602	0.0002602	µg	4	400	0.0000791	0.0002602	0.0002602			
20590-2C	6/12/2013	12:22:30	0.0006882	0.0022635	0.2263482	µg	4	400	0.0006831	0.0022468	0.224679	0.0006932	0.0022802	0.2280174
20590-2C DUP	6/12/2013	12:24:17	0.0007648	0.0025157	0.2515709	µg	4	400	0.0007725	0.0025409	0.2540935	0.0007572	0.0024905	0.2490482
20590-3C	6/12/2013	12:26:03	0.0007639	0.0025126	0.2512638	µg	4	400	0.000764	0.0025128	0.2512798	0.0007639	0.0025125	0.2512478
20590-3C SPK	6/12/2013	12:27:52	0.0260525	0.0856908	8.5690785	µg	4	400	0.0260677	0.0857407	8.5740692	0.0260374	0.0856409	8.5640879
20590-4C	6/12/2013	12:29:40	0.0008531	0.002806	0.2806017	µg	4	400	0.0008538	0.0028082	0.2808232	0.0008524	0.0028038	0.2803801
20590-5C	6/12/2013	12:31:29	6.914E-05	0.0002274	0.0227434	µg	4	400	7.382E-05	0.0002428	0.0242813	6.447E-05	0.0002121	0.0212055
20590-6C	6/12/2013	12:33:18	5.554E-05	0.0001827	0.0182704	µg	4	400	5.607E-05	0.0001844	0.0184429	5.502E-05	0.000181	0.018098
0.004ug = DL	6/12/2013	12:38:52	0.0011817	0.0038869	0.0038869	µg	0	5	0.0011817	0.0038869	0.0038869			
0.080ug = QC STD 3	6/12/2013	12:40:09	0.0266879	0.0877805	0.0877805	µg	0	5	0.0266879	0.0877805	0.0877805			
REAGENT BLANK	6/12/2013	12:41:26	0.0001258	0.0004138	0.0004138	µg	0	5	0.0001258	0.0004138	0.0004138			
Calib Blank	6/14/2013	11:13:40	0.0001585			µg	4	500	0.0001585					
STD1=.004ug	6/14/2013	11:14:54	0.0012139			µg	4	500	0.0012139					

PerkinElmer FIMS-100 CVAA Mercury Analyzer

Sample_ID	Date	Time	Mean_Sig	Mean_Rd	Mean_Rt	Units	Alq.	Vol.	Sig 1	Reading-1	Result-1	Sig 2	Reading-2	Result-2
STD2=.04ug	6/14/2013	11:16:09	0.0112246			µg	4	500	0.0112246					
STD3=.08ug	6/14/2013	11:17:25	0.021361			µg	4	500	0.021361					
STD4=.16ug	6/14/2013	11:18:41	0.0410252			µg	4	500	0.0410252					
STD5=.2ug	6/14/2013	11:19:59	0.0535518			µg	4	500	0.0535518					
Reagent Blank	6/14/2013	11:21:45	-0.0000031	-0.0000117	-0.0000117	µg	4	500	-0.0000013	-0.0000051	-0.0000051	-0.0000048	-0.0000183	-0.0000183
0.004ug = DL	6/14/2013	11:22:58	0.0011303	0.0042787	0.0042787	µg	4	500	0.0011303	0.0042787	0.0042787			
0.080ug = STD.2	6/14/2013	11:24:14	0.0203358	0.0769814	0.0769814	µg	4	500	0.0203358	0.0769814	0.0769814			
0.080ug = QC STD 3	6/14/2013	11:28:05	0.020155	0.0762969	0.0762969	µg	4	500	0.020155	0.0762969	0.0762969			
REAGENT BLANK	6/14/2013	11:29:21	6.72E-06	2.544E-05	2.544E-05	µg	4	500	6.72E-06	2.544E-05	2.544E-05			
0.004ug = DL	6/14/2013	13:13:42	0.0010847	0.0041062	0.0041062	µg	4	400	0.0010847	0.0041062	0.0041062			
0.080ug = STD.2	6/14/2013	13:14:58	0.0193002	0.0730611	0.0730611	µg	4	400	0.0193002	0.0730611	0.0730611			
REAGENT BLANK	6/14/2013	13:16:13	4.339E-05	0.0001643	0.0001643	µg	4	400	4.339E-05	0.0001643	0.0001643			
20590-LRB FH	6/14/2013	13:28:32	5.433E-05	0.0002057	0.0051423	µg	4	100	7.382E-05	0.0002795	0.0069869	3.484E-05	0.0001319	0.0032978
20590-LRB FH SPK	6/14/2013	13:30:15	0.0157455	0.0596046	3.7252875	µg	1.6	100	0.0157527	0.059632	3.7270007	0.0157382	0.0595772	3.7235743
20590-1 FH	6/14/2013	13:31:59	4.865E-05	0.0001842	0.0046044	µg	4	100	0.0000729	0.000276	0.0068991	0.0000244	9.238E-05	0.0023096
20590-2 FH	6/14/2013	13:33:43	0.0001038	0.0003929	0.0098219	µg	4	100	9.166E-05	0.000347	0.008675	0.0001159	0.0004387	0.0109687
0.004ug = DL	6/14/2013	13:34:56	0.0011482	0.0043464	0.0043464	µg	4	100	0.0011482	0.0043464	0.0043464			
0.080ug = STD.2	6/14/2013	13:36:12	0.0194323	0.073561	0.073561	µg	4	100	0.0194323	0.073561	0.073561			
REAGENT BLANK	6/14/2013	13:37:28	5.589E-05	0.0002116	0.0002116	µg	4	100	5.589E-05	0.0002116	0.0002116			
20590-2 FH DUP	6/14/2013	13:39:12	0.00017	0.0006436	0.0160899	µg	4	100	0.0001576	0.0005967	0.0149163	0.0001824	0.0006905	0.0172635
20590-3 FH	6/14/2013	13:40:56	0.0003105	0.0011755	0.029388	µg	4	100	0.0003403	0.0012882	0.0322043	0.0002808	0.0010629	0.0265717
20590-3 FH SPK	6/14/2013	13:42:42	0.0219738	0.083182	2.07955	µg	4	100	0.0219773	0.0831951	2.0798765	0.0219704	0.0831689	2.0792235
20590-4 FH	6/14/2013	13:44:28	0.0001086	0.0004113	0.0102817	µg	4	100	0.0001122	0.0004247	0.0106178	0.0001051	0.0003978	0.0099457
20590-5 FH	6/14/2013	13:46:14	5.056E-05	0.0001914	0.0047856	µg	4	100	4.205E-05	0.0001592	0.0039798	5.908E-05	0.0002237	0.0055915
20590-6 FH	6/14/2013	13:48:00	0.0001508	0.0005708	0.0142693	µg	4	100	0.0001588	0.0006013	0.0150322	0.0001427	0.0005403	0.0135065
0.004ug = DL	6/14/2013	13:52:50	0.0010681	0.0040432	0.0040432	µg	1	1	0.0010681	0.0040432	0.0040432			
0.080ug = QC STD 3	6/14/2013	13:54:06	0.0200297	0.0758227	0.0758227	µg	1	1	0.0200297	0.0758227	0.0758227			
REAGENT BLANK	6/14/2013	13:55:22	3.729E-05	0.0001412	0.0001412	µg	1	1	3.729E-05	0.0001412	0.0001412			
Calib Blank	6/17/2013	10:44:20	0.0002714			µg			0.0002714					
STD1=.004ug	6/17/2013	10:45:34	0.0012171			µg			0.0012171					
STD2=.04ug	6/17/2013	10:46:51	0.0134286			µg			0.0134286					
STD3=.08ug	6/17/2013	10:48:08	0.0261513			µg			0.0261513					
STD4=.16ug	6/17/2013	10:49:25	0.0547656			µg			0.0547656					
STD5=.2ug	6/17/2013	10:50:44	0.0690879			µg			0.0690879					
Reagent Blank	6/17/2013	10:52:32	0.0003626	0.0010584	0.0010584	µg			0.0004297	0.0012544	0.0012544	0.0002955	0.0008624	0.0008624
0.004ug = DL	6/17/2013	10:55:01	0.0013469	0.0039316	0.0039316	µg			0.0013469	0.0039316	0.0039316			
0.080ug = STD.2	6/17/2013	10:56:18	0.0262171	0.0765262	0.0765262	µg			0.0262171	0.0765262	0.0765262			
0.080ug = QC STD 3	6/17/2013	10:57:38	0.0261867	0.0764376	0.0764376	µg			0.0261867	0.0764376	0.0764376			
REAGENT BLANK	6/17/2013	10:58:54	0.0002475	0.0007223	0.0007223	µg			0.0002475	0.0007223	0.0007223			
20590-LRB FH SPK	6/17/2013	11:07:51	0.0277125	0.0808915	5.0557178	µg	1.6	100	0.02814	0.0821391	5.1336942	0.0272851	0.0796439	4.9777414
0.004ug = DL	6/17/2013	11:19:29	0.0014421	0.0042095	0.0042095	µg	20	1	0.0014421	0.0042095	0.0042095			
0.080ug = STD.2	6/17/2013	11:20:46	0.0250473	0.0731116	0.0731116	µg	20	1	0.0250473	0.0731116	0.0731116			
REAGENT BLANK	6/17/2013	11:22:04	-0.000001	-0.0000031	-0.0000031	µg	20	1	-0.000001	-0.0000031	-0.0000031			

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PLANT DATA

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I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified as accurate.

QA/QC Initials: SB

Date: 7/16

CleanAir.

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WHEELABRATOR NORTH BROWARD
TONS OF REFUSE PROCESSED PER STACK TEST RUN LOG

UNIT #3

Date	Test	Method #	Run #	Steam (klb/hr)	Run Length (hr)	Trash Processed (tons)
6/4/2013	Mercury	29	1	183.7	2.20	76.3
6/5/2013	Mercury	29	2	178.4	2.20	74.0
6/5/2013	Mercury	29	3	176.9	2.18	72.8
6/5/2013	Mercury	29	4	177.1	2.20	73.5

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 06/04/13
Start Time: 11:51
End Time: 14:03

	Test	SDA INLET TEMP	SDA OUTLET TEMP	TOTAL SLURRY FL	DIL WATER FLOW	TOTAL LIME	LIME CONC	FF OUT TEMP	FF DP	ID INLET PRESS
		DEG F	DEG F	GPM	GPM	GPM	%	DEG F	" H2O	" H2O
Unit 1		521.64	298.59	51.88	36.87	15.01	23.49	282.71	6.38	-9.95
Unit 2		482.70	290.32	39.04	26.78	12.26	31.26	266.29	6.09	-9.54
Unit 3	29 run 1	520.74	291.75	59.39	47.09	12.30	20.51	282.14	6.36	-6.75

	FEED H2O FLOW	SH OUT STM PRESS	FINAL STM TEMP	TOT AIR FLOW	FURNACE DRAFT	ECONO OUT TEMP	SH ROLL AVG	SNCR CHEM FLOW	STEAM FLOW
	KLBs/hr	DEG F	DEG F	KSCFM	" H2O	DEG F	DEG F	GPH	KLBs/hr
Unit 1	174.67	887.08	821.71	91.41	-0.10	255.85	1151.55	5.12	170.11
Unit 2	183.32	890.17	833.69	88.36	-0.10	0.00	1122.32	2.08	173.55
Unit 3	189.27	894.24	828.72	89.15	-0.10	266.25	1196.09	9.86	183.74

U1 lime (#/hr)	879.52	
U2 lime (#/hr)	718.31	
U3 lime (#/hr)	720.59	
Specific Gravity	1.093	
Round Down	1.090	0.941
Round Up	1.100	1.050

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 06/05/13
Start Time: 7:32
End Time: 9:44

	Test	SDA INLET TEMP	SDA OUTLET TEMP	TOTAL SLURRY FL	DIL WATER FLOW	TOTAL LIME	LIME CONC	FF OUT TEMP	FF DP	ID INLET PRESS
		DEG F	DEG F	GPM	GPM	GPM	%	DEG F	" H2O	" H2O
Unit 1		525.97	301.04	50.46	32.84	17.62	27.54	286.13	6.27	-9.52
Unit 2		493.13	289.91	40.83	26.84	13.98	33.98	267.56	5.99	-9.45
Unit 3	29 run 2	507.93	289.86	54.28	40.43	13.85	25.57	282.38	6.24	-6.31

	FEED H2O FLOW	SH OUT STM PRESS	FINAL STM TEMP	TOT AIR FLOW	FURNACE DRAFT	ECONO OUT TEMP	SH ROLL AVG	SNCR CHEM FLOW	STEAM FLOW
	KLBs/hr	DEG F	DEG F	KSCFM	" H2O	DEG F	DEG F	GPH	KLBs/hr
Unit 1	181.88	889.34	835.62	89.75	-0.09	256.14	1170.30	5.74	175.81
Unit 2	186.60	891.45	829.05	87.35	-0.10	0.00	1165.46	1.98	177.04
Unit 3	184.47	893.83	828.81	83.23	-0.11	266.53	1170.27	7.78	178.37

U1 lime (#/hr)	944.81	
U2 lime (#/hr)	749.74	
U3 lime (#/hr)	742.57	
Specific Gravity	1.086	
Round Down	1.080	0.833
Round Up	1.090	0.941

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 06/05/13
Start Time: 10:02
End Time: 12:13

	Test	SDA INLET TEMP	SDA OUTLET TEMP	TOTAL SLURRY FL	DIL WATER FLOW	TOTAL LIME	LIME CONC	FF OUT TEMP	FF DP	ID INLET PRESS
		DEG F	DEG F	GPM	GPM	GPM	%	DEG F	" H2O	" H2O
Unit 1		510.47	299.71	48.05	28.72	19.33	28.89	284.55	6.40	-9.64
Unit 2		493.23	290.51	40.56	26.55	14.01	34.37	268.75	6.21	-9.66
Unit 3	29 run 3	505.44	290.22	51.63	37.84	13.79	26.82	282.19	6.27	-6.16

	FEED H2O FLOW	SH OUT STM PRESS	FINAL STM TEMP	TOT AIR FLOW	FURNACE DRAFT	ECONO OUT TEMP	SH ROLL AVG	SNCR CHEM FLOW	STEAM FLOW
	KLBs/hr	DEG F	DEG F	KSCFM	" H2O	DEG F	DEG F	GPH	KLBs/hr
Unit 1	182.17	889.11	829.50	90.71	-0.10	256.36	1139.75	4.57	176.55
Unit 2	185.61	891.11	828.99	88.71	-0.09	0.00	1178.58	1.69	176.37
Unit 3	183.51	893.51	831.08	81.98	-0.10	266.69	1179.13	7.29	176.93

U1 lime (#/hr)	1036.93	
U2 lime (#/hr)	751.57	
U3 lime (#/hr)	739.99	
Specific Gravity	1.086	
Round Down	1.080	0.833
Round Up	1.090	0.941

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 06/05/13
Start Time: 12:30
End Time: 14:42

	Test	SDA INLET TEMP	SDA OUTLET TEMP	TOTAL SLURRY FL	DIL WATER FLOW	TOTAL LIME	LIME CONC	FF OUT TEMP	FF DP	ID INLET PRESS
		DEG F	DEG F	GPM	GPM	GPM	%	DEG F	" H2O	" H2O
Unit 1		516.26	300.08	48.49	30.49	18.00	27.35	284.63	6.38	-9.50
Unit 2		480.65	289.45	37.62	24.04	13.58	35.32	267.99	6.07	-9.27
Unit 3	29 run 4	506.57	289.99	51.46	38.01	13.45	25.78	282.41	6.21	-6.04

	FEED H2O FLOW	SH OUT STM PRESS	FINAL STM TEMP	TOT AIR FLOW	FURNACE DRAFT	ECONO OUT TEMP	SH ROLL AVG	SNCR CHEM FLOW	STEAM FLOW
	KLBs/hr	DEG F	DEG F	KSCFM	" H2O	DEG F	DEG F	GPH	KLBs/hr
Unit 1	182.88	889.27	828.53	89.18	-0.10	256.57	1159.01	4.54	177.45
Unit 2	187.57	891.43	830.93	85.10	-0.10	0.00	1126.22	1.61	177.86
Unit 3	182.93	893.31	826.31	81.67	-0.10	266.83	1184.74	6.58	177.13

U1 lime (#/hr)	997.33	
U2 lime (#/hr)	752.47	
U3 lime (#/hr)	745.08	
Specific Gravity	1.088	
Round Down	1.080	0.833
Round Up	1.090	0.941

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DESCRIPTION OF INSTALLATION

PROCESS DESCRIPTION

The North Broward Resource Recovery facility operates three (3) 750 tons-per-day municipal refuse-fired, water-wall boiler trains. The trains were manufactured by Babcock & Wilcox to produce electricity for sale to a local utility company.

Each boiler is equipped with the following air pollution controls (APCs):

1) A selective non-catalytic reduction (SNCR) for nitrogen oxides (NO_X) control;
2) A spray dry absorber (SDA) for acid gas removal;
3) A fabric filter for the control of particulate emissions.

Each fabric filter is followed by an induced draft (ID) fan that directs the flue gas to a dedicated flue in a common stack. The APC equipment is manufactured by Wheelabrator Air Pollution Control, Inc. All APC equipment is generally in excellent condition. Each boiler is also equipped with a continuous emission monitoring (CEM) system to demonstrate the compliance with sulfur dioxide (SO_2), NO_X and carbon monoxide (CO) limits.

Figure 3-1 shows a general schematic for the facility. All of the testing reported in this document was performed at the Unit 3 FF Outlet, as shown in Figure 3-2 on page 3-2.

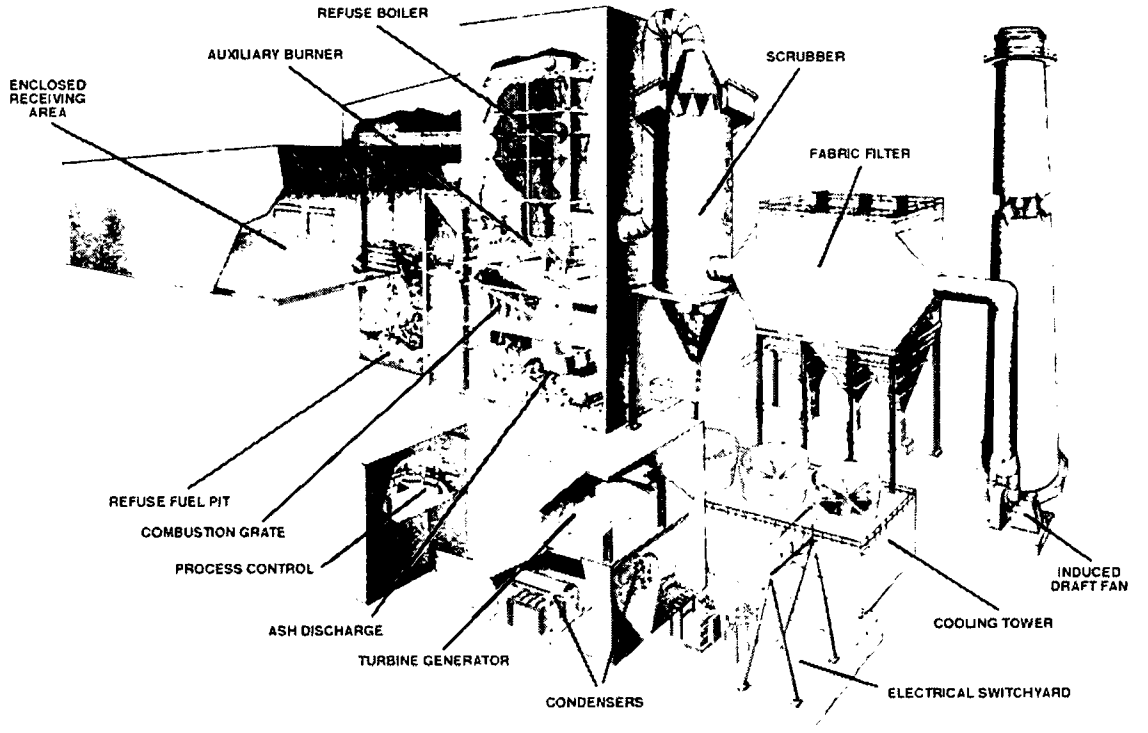


Figure 3-1: General Process Schematic

DESCRIPTION OF INSTALLATION

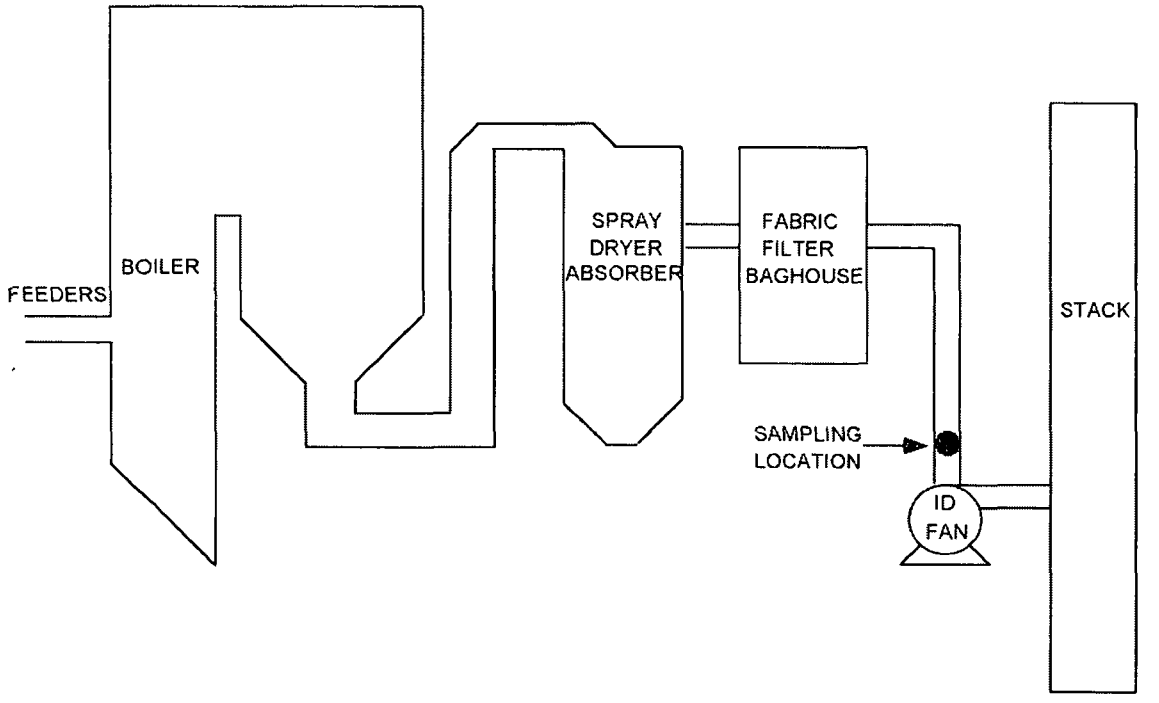


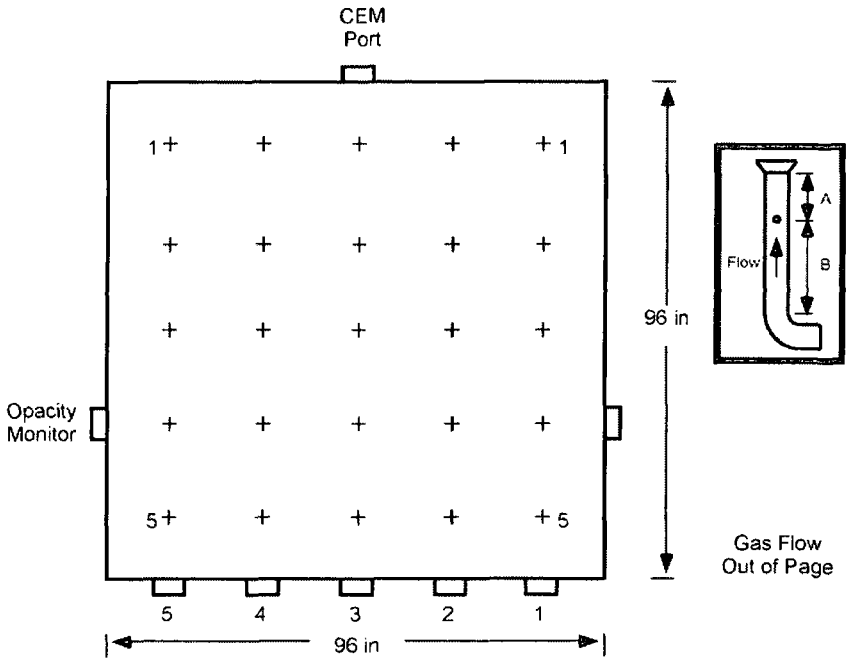
Figure 3-2: Process Schematic

DESCRIPTION OF SAMPLING LOCATION

Sampling point locations were determined according to EPA Method 1. Table 3-1 outlines the sampling point configurations. Figure 3-3 illustrates the sampling points and orientation of sampling ports for the source tested in the program.

Table 3-1:
Sampling Points

Location	Constituent	Method	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
Unit 3 FF Outlet	Mercury	29	1-4	5	5	5	125	3-3



Sampling Point	Port to Point Distance (in.)
1	86.4
2	67.2
3	48.0
4	28.8
5	9.6

Equivalent Duct diameters upstream from flow disturbance (A):	0.5	Limit: 0.5
Equivalent Duct diameters downstream from flow disturbance (B):	2.0	Limit: 2.0

Figure 3-3: Unit 3 FF Outlet Sampling Point Determination (EPA Method 1)

End of Section 3 – Description of Installation

11. Mercury emission rate - Fd-based (lb/MMBtu)

$$E_{Fd} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205 \times 10^{-3}}{10^6}\right)(F_d)\left(\frac{20.9}{20.9 - O_2}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
F_d	= ratio of gas volume to heat content of fuel (dscf/MMBtu)	=	9,570	dscf/MMBtu
O_2	= proportion of oxygen in the gas stream by volume (%)	=	9.1	%
20.9	= oxygen content of ambient air (%)	=	20.9	%
E_{Fd}	= mercury emission rate - Fd-based (lb/MMBtu)	=	6.2351E-06	lb/MMBtu

12. Mercury emission rate - Fc-based (lb/MMBtu)

$$E_{Fc} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205 \times 10^{-3}}{10^6}\right)(F_c)\left(\frac{100}{CO_2}\right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	13.1804	µg
V_{mstd}	= volume metered, standard (dscf)	=	79.2321	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
F_c	= ratio of gas volume to heat content of fuel (dscf/MMBtu)	=	1,820	dscf/MMBtu
CO_2	= proportion of oxygen in the gas stream by volume (%)	=	9.8	%
100	= conversion factor	=	100	
E_{Fc}	= mercury emission rate - Fc-based (lb/MMBtu)	=	6.8121E-06	lb/MMBtu

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