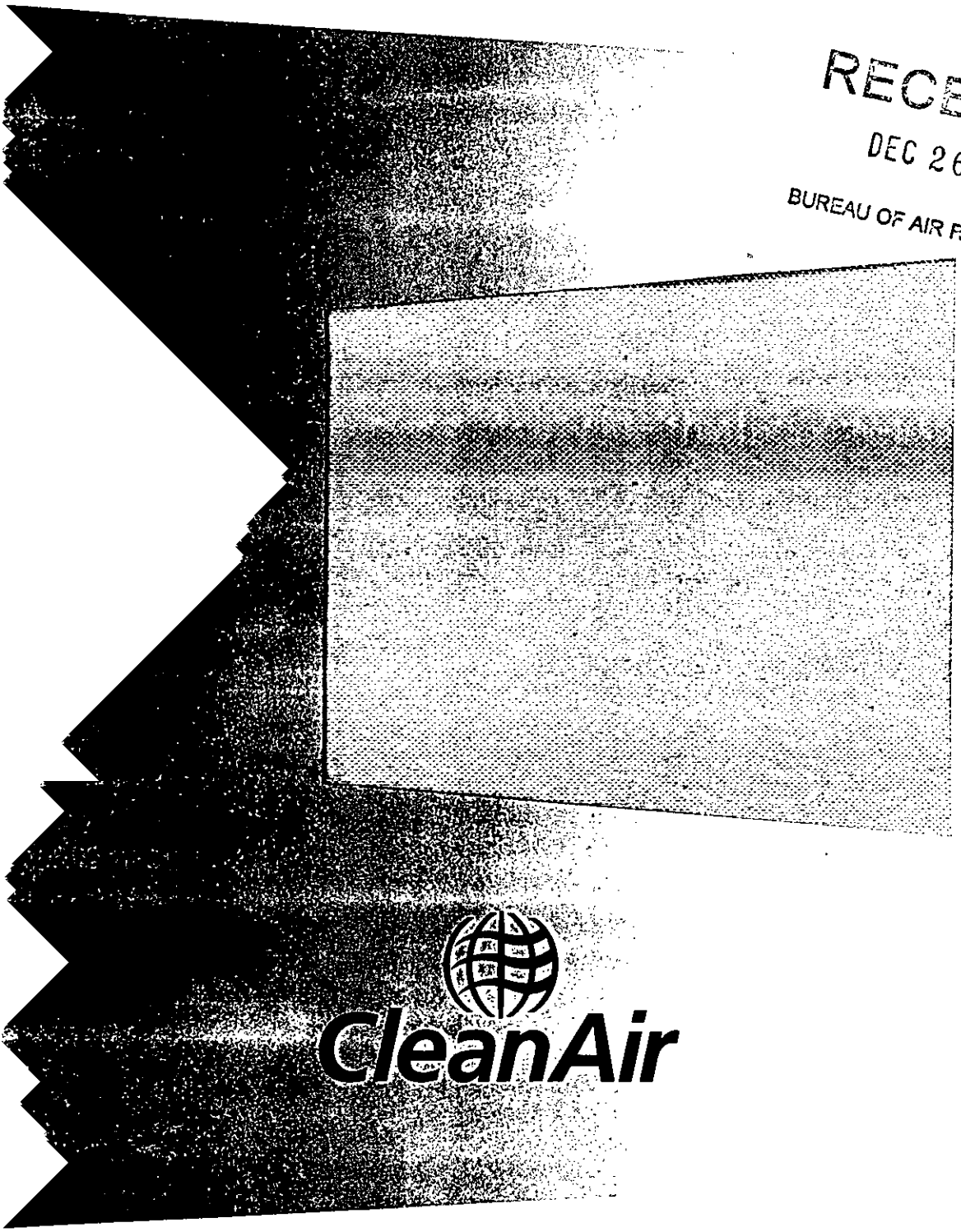


CleanAir

REPORT ON MERCURY TES

WHEELABRATOR NORTH BROWA
UNIT 3 FF OUTLET
POMPANO BEACH, FLORIDA

CLIENT REFERENCE NO: 14200357
CLEANAIR PROJECT NO: 9156-3
REVISION 0: DECEMBER 18, 2002

01/2120

PSD-FL-112

CleanAir

CleanAir Engineering
500 W. Wood Street
Palatine, IL 60067-4975
800-627-0033
www.cleanair.com

Wheelabrator North Broward
2600 NW 48th Street
Pompano Beach, FL 33073

REPORT ON MERCURY TESTING

Performed for:
WHEELABRATOR NORTH BROWARD
UNIT 3 FF OUTLET
POMPANO BEACH, FLORIDA

Client Reference No: 14200357
CleanAir Project No: 9156-3
Revision 0: December 18, 2002

To the best of our knowledge, the data presented in this report are accurate, complete and error free, legible and representative of the actual emissions during the test program.

Submitted by,

Scott Brown

Reviewed by,

Peter Kaufmann

CONTENTS

PROJECT OVERVIEW

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. Wheelabrator North Broward, Inc. contracted Clean Air Engineering (CleanAir) to perform a compliance test program at their 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 December 3, 2002.

The testing included the determination of the following constituents:

- moisture (H_2O);
- oxygen (O_2);
- carbon dioxide (CO_2);
- total flow (dscfm);
- mercury (Hg).

Coordinating and observing the field portion of the program were:

C. Faller	- Wheelabrator North Broward, Inc.
K. O'Halloren	- CleanAir

The schedule of activities is shown in Table 1-1. A summary of the results is presented in Table 1-2 on page 1-2.

Table 1-1:
Schedule of Activities

Date (2002) Start Time	Stop Time	Unit	Location	Pollutant	Method	Run No.
December 3						
07:47	09:58	3	FF Outlet	Mercury	EPA 29	1
09:59	12:09	3	FF Outlet	Mercury	EPA 29	2
12:10	16:21	3	FF Outlet	Mercury	EPA 29	3

PROJECT OVERVIEW

Table 1-2:
Summary of Test Results

Source Constituent (Units)	Sampling Method	Average Emission	Permit Limit[1]
Unit 3 FF Outlet			
Mercruy (µg/dscm @ 7% O_2)	EPA M29	18.3	70

[1] Limits obtained from 40 Code of Federal Register part 60 Subpart Cb - Emission Guidelines and Compliance Times for Large Municipal Waste Combustors That Are Constructed on or Before September 20, 1994 published in Federal Register as 62 FR 45123 on December 19, 1995 as modified on August 25, 1997, 40 CFR 60.33b (a) (3), Rule 62-296.416 (3) (b) and and PSD-FL-112.

The delay during Run 3 was due to the units load dropping below the required 90% of full load because of wet garbage.

The test conditions and results of analysis are presented in Table 2-1 on page 2-1 and the Quality Control and Quality Assurance Results are shown in Table 2-2 on page 2-2.

WHEELABRATOR NORTH BROWARD
POMPANO BEACH, FLORIDA

Client Reference No: 14200357
CleanAir Project No: 9156-3

RESULTS

Table 2-1:
Unit 3 FF Outlet - Mercury

Run No.		1	2	3	Average
Date (2002)		Dec 3	Dec 3	Dec 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Process Conditions					
R_P	Steam Flow - (Klbs/hour)	184.5	184.9	185.8	**185.1**
P_1	Fabric Filter Inlet Temperature (°F)	320.1	320.0	319.0	**319.7**
F_d	Oxygen-based F-factor (dscf/MMBtu)	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**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	11.2	11.1	9.7	**10.7**
CO_2	Carbon dioxide (dry volume %)	8.1	8.7	8.9	**8.6**
T_s	Sample temperature (°F)	306	307	305	**306**
B_w	Actual water vapor in gas (% by volume)	20.55	21.43	20.41	**20.79**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	190,450	186,853	194,453	**190,585**
Q_s	Volumetric flow rate, standard (scfm)	127,922	125,148	130,700	**127,923**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	101,636	98,331	104,029	**101,332**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	85.158	79.359	86.435	**83.651**
%I	Isokinetic sampling (%)	100.4	96.7	99.5	**98.9**
Laboratory Data					
$m_{n\text{-}1b}$	Fraction 1B Prorated (µg)	4.0337	5.4231	5.1659	**4.8743**
$m_{n\text{-}2b}$	Fraction 2B Prorated (µg)	22.7345	19.1375	35.8634	**25.9118**
$m_{n\text{-}3a}$	Fraction 3A Prorated (µg)	0.0000	0.0000	0.0000	**0.0000**
$m_{n\text{-}3b}$	Fraction 3B Prorated (µg)	0.0000	0.0000	0.0000	**0.0000**
$m_{n\text{-}3c}$	Fraction 3C Prorated (µg)	1.4422	1.6247	1.3634	**1.4768**
m_n	Total matter corrected for allowable blanks (µg)	28.2104	26.1853	42.3927	**32.2628**
Mercury Results - Total					
C_{sd}	Concentration (lb/dscf)	7.30E-10	7.28E-10	1.08E-09	**8.46E-10**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	1.05E-09	1.03E-09	1.35E-09	**1.14E-09**
C_{sd}	Concentration (µg/dscm)	11.7	11.7	17.3	**13.6**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	16.8	16.5	21.6	**18.3**
$E_{lb/hr}$	Rate (lb/hr)	4.45E-03	4.29E-03	6.75E-03	**5.17E-03**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	1.51E-05	1.48E-05	1.94E-05	**1.64E-05**

121602 153159

RESULTS

Table 2-2:
Quality Assurance and Quality Control
RPD RESULTS

Run Number	Front half	H_2O_2/HNO_3	Empty Impinger	KMnO4	HCl
North Run 1	1.6%	2.4%	NA	NA	0.4%
North Run 2	2.8%	1.1%	NA	NA	1.9%
North Run 3	2.7%	0.9%	NA	NA	2.8%
Field Blank	NA	NA	NA	NA	2.5%
Reagent Blank	NA	NA	NA	NA	4.7%

Sample Spike and Recovery

Run Number		Front half	H_2O_2/HNO_3	Empty Impinger	$KMnO_4$	HCl
North Run 3	# 1	123%	103%	98%	97%	105%
	# 2	117%	93%	99%	95%	103%

DESCRIPTION OF INSTALLATION

The North Broward Resource Recovery Facility operates three 750 tons per day municipal refuse fired, water wall boiler trains. The trains were manufactured by Babcock and Wilcox to produce electricity for sale to a local utility company. Each boiler is equipped a spray dryer absorber (SDA) for acid gas removal, followed by a fabric filter (FF) baghouse for the control of particulate emissions. The control equipment is manufactured by Wheelabrator Air Pollution Control, Inc. Each fabric filter baghouse is followed by an induced draft fan, which directs the flue gas to a dedicated flue in a common stack.

Figure 3-1 shows a general schematic for the facility. The testing occurred at the Unit 3 FF Outlet as shown in Figure 3-1.

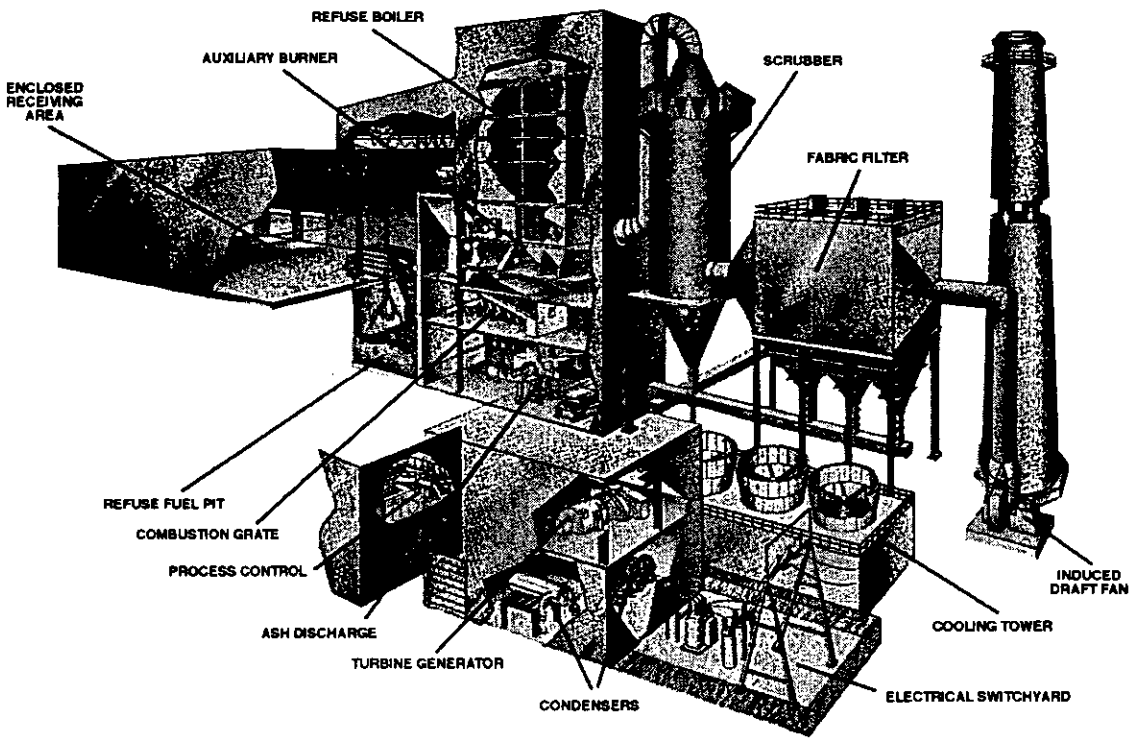


Figure 3-1: Process Schematic

DESCRIPTION OF INSTALLATION

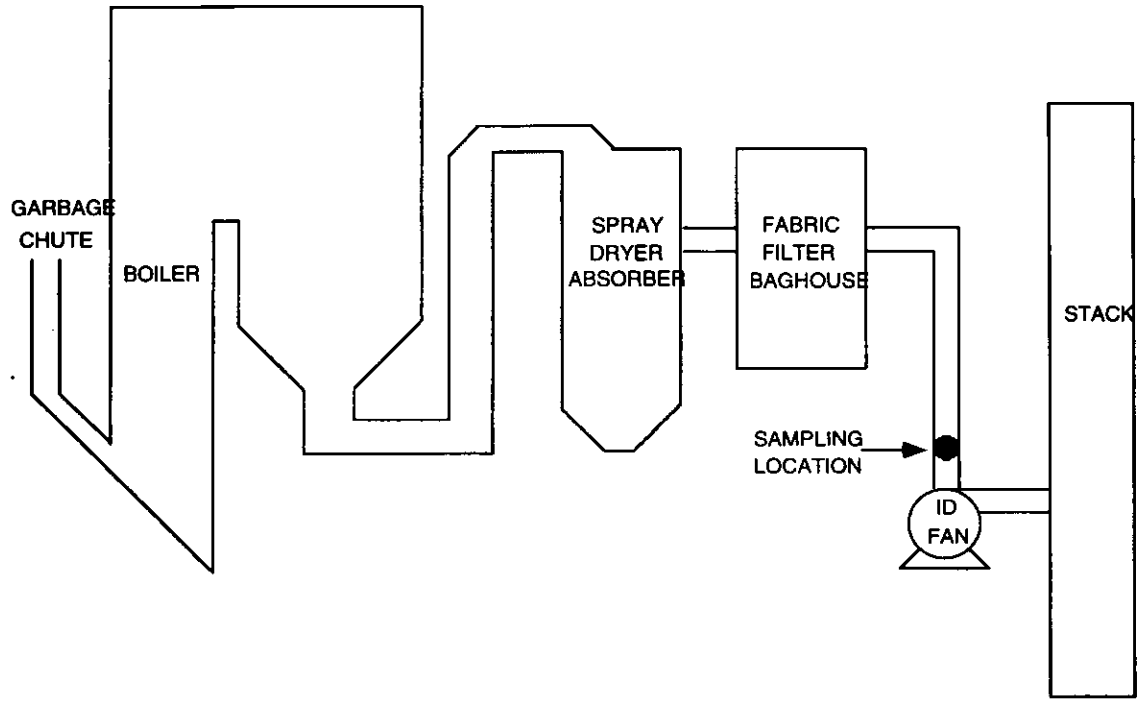


Figure 3-2: Process Schematic

METHODOLOGY

The sampling followed procedures as detailed in U.S. Environmental Protection Agency (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 on the World Wide Web at http://www.cleanair.com.

These sampling, recovery and analytical procedures are summarized on pages 4-1 through 4-7.

The sampling nozzles were calibrated on site. All other equipment was calibrated at the Clean Air Engineering laboratory prior to shipment to the job site. A post-test calibration was performed on the meter boxes at the conclusion of testing to verify that calibration was maintained throughout the test program. Calibration sheets can be found in Appendix Section C.

SAMPLING POINT DETERMINATION - EPA METHOD 1

Sampling point locations were determined according to EPA Method 1.

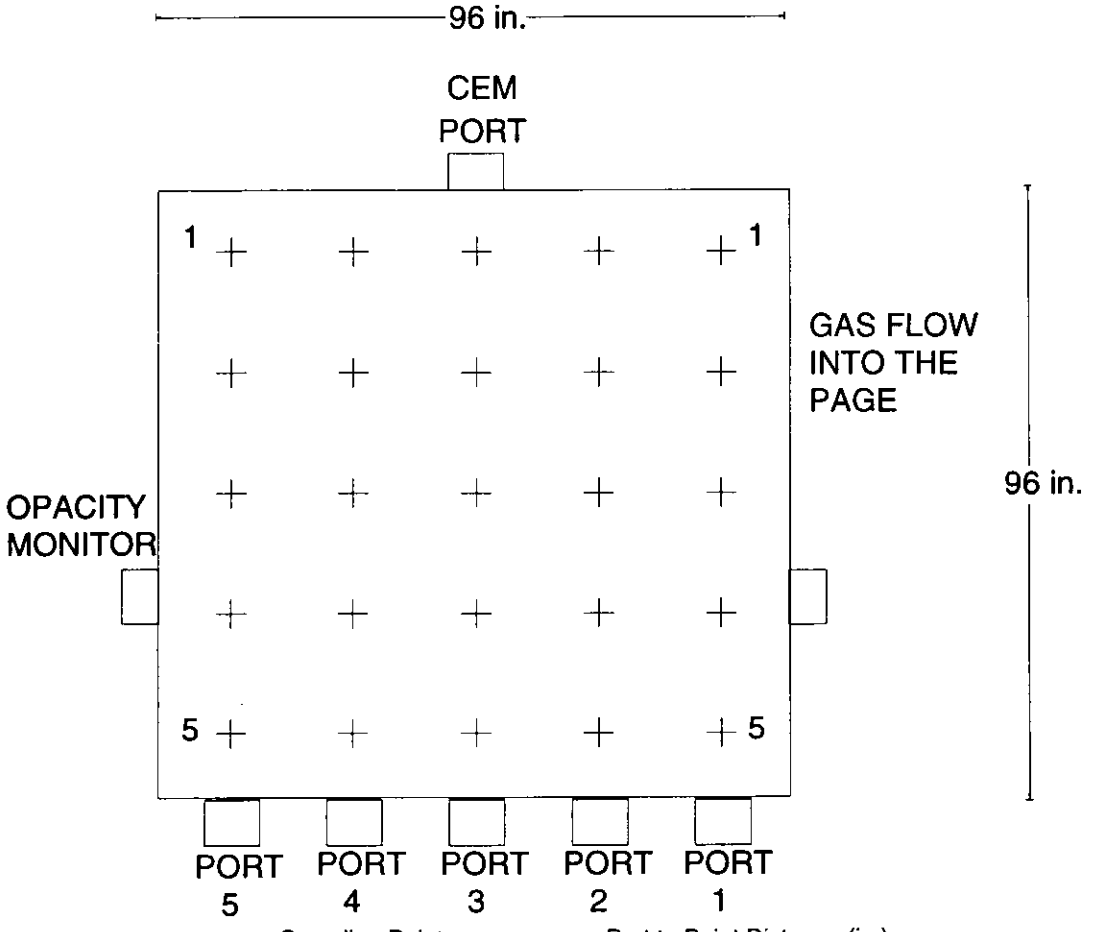
Table 4-2 outlines the sampling point configurations. Figure 4-1 illustrates the sampling points and orientation of sampling ports for the source tested in the program.

Table 4-2:
Sampling Points

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

METHODOLOGY

SAMPLING POINT DETERMINATION (CONTINUED)



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

Diameters upstream from disturbance: 2 diameters — Limit: 2
Diameters downstream from disturbance: 0.5 diameters — Limit: 0.5

Figure 4-1: Unit 3 FF Outlet - Sampling Point Determination (EPA Method 1)

METHODOLOGY

VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2

EPA Method 2 was used, in conjunction with the wet method testing, to determine the gas velocity and flow rate at the FF Outlet test location.

Each set of velocity determinations included the measurement of gas velocity pressure and gas temperature at each of the EPA Method 1 traverse points. The velocity pressures were measured with a Type S pitot tube. Gas temperature measurements were made using a Type K thermocouple and digital pyrometer. Figure 4-2 includes the components of the EPA Method 2 sampling apparatus.

GAS COMPOSITION AND MOLECULAR WEIGHT - EPA METHOD 3B

In order to determine the oxygen (O_2) concentration, carbon dioxide (CO_2) concentration and gas molecular weight, a time-integrated sample of the gas was obtained for each sampling train and analyzed in accordance with EPA Method 3B. The gas sample was collected into a vinyl sample bag from isokinetic test methods. The contents of the bag was analyzed for O_2 and CO_2 concentrations using an Orsat gas analyzer.

MOISTURE CONTENT - EPA METHOD 4

The flue gas moisture content at each of the test locations was determined in accordance with EPA Method 4, in conjunction with the mercury testing. Figure 4-2 includes the components of the EPA Method 4 sampling apparatus. The gas moisture was determined by quantitatively condensing the moisture in chilled impingers. The amount of moisture condensed was determined gravimetrically. A dry gas meter was used to measure the volume of gas sampled. The amount of water condensed and the volume of gas sampled were used to calculate the gas moisture content in accordance with EPA Method 4.

METHODOLOGY

MERCURY EMISSIONS - EPA METHOD 29

EPA Method 29 was used to measure mercury emissions at the Unit 3 FF Outlet. This method defines metal emissions as particulate and gaseous material isokinetically withdrawn through a temperature controlled probe and collected on a high-efficiency filter and in acidified absorbing solutions.

Figure 4-2 illustrates the EPA Method 29 sampling train which was used. The sampling apparatus contained a glass-lined temperature-controlled probe equipped with a pitot tube (for measuring stack flow rate) and a sharp-edged glass button-hook nozzle. The exit of the probe was connected to a high efficiency quartz fiber filter (Pallflex 2500QAT-UP) supported in a glass filter holder inside an oven. The exit of the filter holder connected directly to a series of seven full size impingers.

The first impinger of the sampling train was left empty to accommodate collection of the flue gas moisture. The second and third impingers of the sampling apparatus each contained 100 milliliters of 5% nitric acid/10% hydrogen peroxide solution. The fourth impinger was left empty. The fifth and sixth impingers each contained 100 milliliters of 4% potassium permanganate/10% sulfuric acid solution. The seventh impinger contained 200 to 300 grams of silica gel. All of the impingers were maintained at a temperature below 68°F for the duration of each test.

Procedures for selecting sampling locations and for the operation of the apparatus was derived from EPA Method 29 and associated EPA Methods 1 through 5. The entire sampling apparatus was leak-checked before and after each test run. Sampling was performed at an average isokinetic rate greater than 90% and less than 110%.

At the conclusion of each test run, the probe and nozzle was rinsed and brushed with 0.1 Normal nitric acid to remove any particulate matter. These rinses were collected into polyethylene sample containers. The quartz fiber filter was recovered and placed into a polyethylene sample container. The volume of liquid collected in each of the impingers was quantified.

The liquid from the first three impingers was transferred to a leak-free polyethylene storage container. The back-half of the filter housing, the first three impingers and all connecting glassware were rinsed with 0.1 Normal nitric acid which was be added to the storage container.

METHODOLOGY

MERCURY EMISSIONS (CONTINUED)

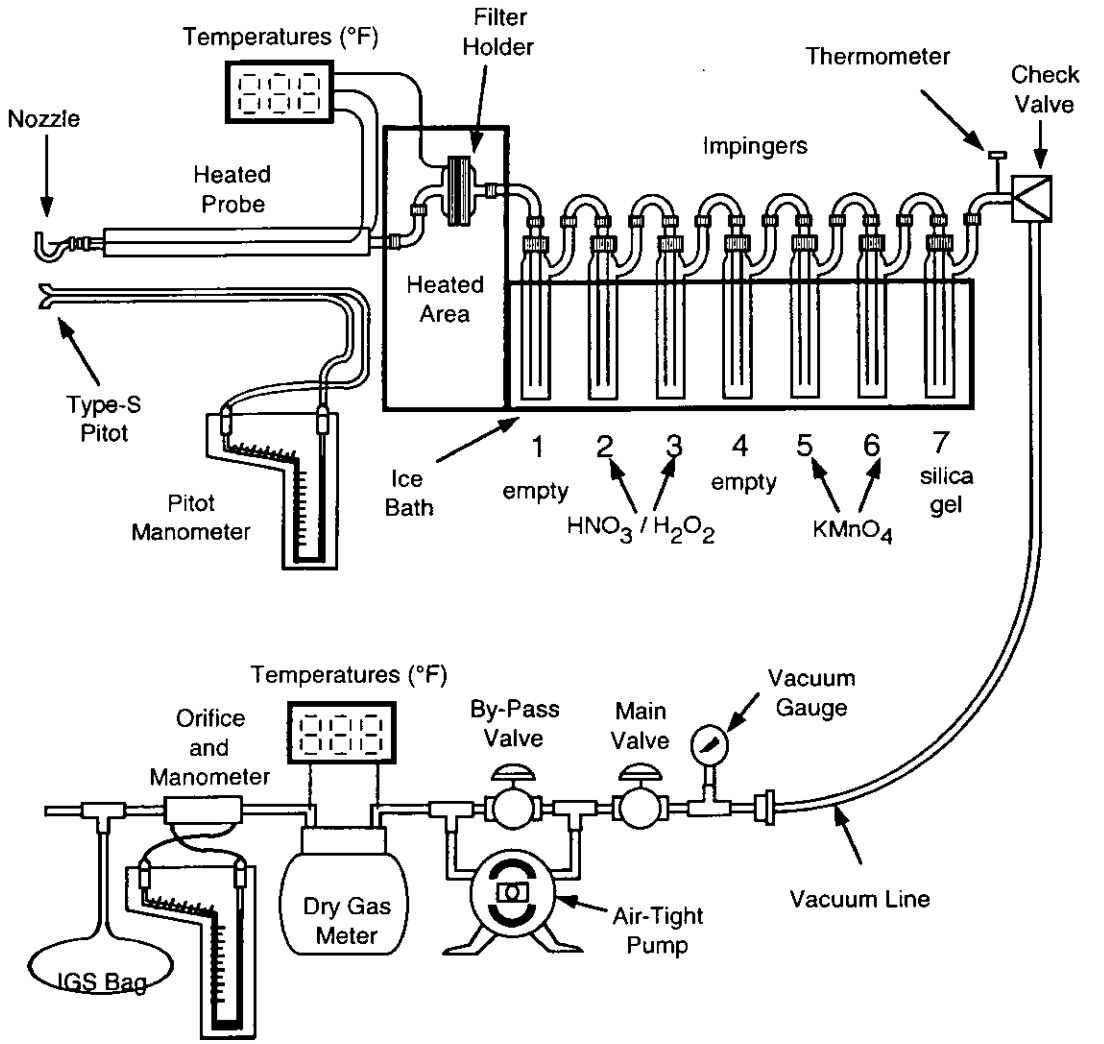
Any liquid collected in the fourth impinger was transferred to a separate polyethylene container, and the impinger was rinsed into the same container with 0.1 Normal nitric acid. The contents of impingers 5 and 6 were collected into an amber glass container. Both impingers 5 and 6 and the connecting glassware were then rinsed with acidified potassium permanganate followed by distilled water. These rinses were collected in the glass container. Any residual potassium permanganate retained by the impingers was removed using a rinse of 8 Normal hydrochloric acid, which was collected into a separate glass container. 200 milliliters of distilled water was used to rinse impingers 5 and 6 and added to the same container to also dilute the acid.

All containers were sealed, labeled and liquid levels marked prior to transport to the laboratory. The silica gel weight and the volume of condensate collected in the impingers were used to determine moisture content of the stack gas.

The nitric acid probe rinses, and samples recovered from impingers 1 through 3 were reduced to near dryness and digested with hydrofluoric acid and concentrated nitric acid. The filter was digested with hydrofluoric and nitric acids. The samples obtained from Impingers 4, 5 and 6 were digested separately with acidified potassium permanganate and subsequently analyzed only for mercury. The digested samples were analyzed by cold vapor atomic absorption spectroscopy (CVAAS per Method 7470 in EPA publication SW 846) for mercury by Element One, Inc of Wilmington, North Carolina.

METHODOLOGY

MERCURY EMISSIONS (CONTINUED)



Impinger Contents
1) empty
2) 100 ml 5% HNO_3/10% H_2O_2
3) 100 ml 5% HNO_3/10% H_2O_2
4) empty
5) 100 ml 4% $KMnO_4$/10% H_2SO_4
6) 100 ml 4% $KMnO_4$/10% H_2SO_4
7) 300 g silica gel

Figure 4-2: Metals Sampling Apparatus (EPA Method 29)

METHODOLOGY

QUALITY ASSURANCE AND QUALITY CONTROL

All testing followed the EPA quality assurance and quality control guidelines as outlined in the respective methods. Field blanks and matrix spikes for the mercury testing were done as shown in the following Table 4-3. The results of the analysis are shown in Table 2-2.

Table 4-3:
Method Field Blanks and Matrix Spikes

Method	Reagent Blank Sets	Field Blank	Duplicate Analysis	Matrix Spikes
EPA M29	1	1	On all analysis	1 predigested filter blank and 1 postdigested sample

WHEELABRATOR NORTH BROWARD
POMPANO BEACH, FLORIDA

Client Reference No: 14200357
CleanAir Project No: 9156-3

APPENDIX

SAMPLE CALCULATIONS

A

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

EPA Method 1-4 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 throughtout. The final table is formatted to an appropriate number of significant figures.

121602 145711

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04707)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	467.9	ml
0.04707	= ideal gas conversion factor (ft^3 water vapor/ml or gm)	=	0.04707	ft^3/ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft^3)	=	22.02	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)	=	30.10	in. Hg
T_m	= average dry gas meter temperature (°F)	=	77.70	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)		85.73	dcf
Y_d	= gas meter correction factor (dimensionless)	=	1.0024	
ΔH	= average pressure drop across meter box orifice (in. H_2O)	=	1.42	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)	=	85.158	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)	=	30.10	in. Hg
P_g	= sample gas static pressure (in. H_2O)	=	-12.70	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)	=	29.17	in. Hg

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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)	=	306.28	°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	= temerature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	29.17	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)	=	29.17	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	29.17	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)	=	85.158	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	22.02	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2055	
		=	20.55	%

7. Saturated moisture content (% by volume)

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

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.17	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	29.17	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions		1.0000	
		=	100.00	%

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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	=	0.2055	
B_w	= actual water vapor in gas	=	0.2055	
		=	20.55	%

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 (%)	=	8.1	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	11.2	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	80.67	%

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 (%)	=	8.1	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	11.2	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	80.7	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb·mole)	=	29.75	%

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	=	0.2055	
M_d	= dry molecular weight of sample gas (lb/lb·mole)	=	29.75	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)	=	27.34	lb/lb·mole

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

12. Velocity of sample gas (ft/sec)

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

Where:				
K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.84	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb·mole)	=	27.34	lb/lb·mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.17	in. Hg
T_s	= average sample gas temperature (°F)	=	306.28	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H_2O)	=	0.704	$\sqrt{}$in. H_2O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	49.60	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)	=	49.60	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	190,450	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)	=	190,450	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.17	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	306.3	°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)	=	127,922	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	=	0.2055	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	127,922	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	101,636	dscfm

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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)	=	101,636	dscfm
O_2	= proportion of oxygen in the gas stream by volume (%)	=	11.2	%
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)	=	70,926	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)	=	101,636	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	6,098,167	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)	=	101,636	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)	=	172,704	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)	=	172,704	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)	=	160,928	dry Nm^3/hr

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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)	=	0.280	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2055	
P_s	= absolute sample gas pressure (in. Hg)	=	29.17	in. Hg
T_s	= average sample gas temperature (°F)	=	306.3	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	85.158	dscf
V_s	= sample gas velocity (ft/sec)	=	49.60	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 (%)	=	100.38	%

QA/QC _____
Date _____

EPA Method 29 Sample Calculations - Mercury Analytical Result

Sample data taken from Run 1

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 throughtout. 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.

121602 135720

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	=	<0.3000	µg
m_{3a-B}	= mercury amount in blank for Fraction 3a	=	<0.2000	µg
m_{3b-B}	= mercury amount in blank for Fraction 3b	=	<0.4000	µg
m_{3c-B}	= mercury amount in blank for Fraction 3c	=	0.9431	µg
$m_{total-B}$	= total amount of mercury in blank	=	0.9431	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	=	4.1685	µg
m_{2b-S}	= mercury amount in sample for Fraction 2b	=	23.4945	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	=	1.4904	µg
$m_{total-S}$	= total amount of mercury in sample	=	29.1534	µg

3. Allowable blank correction (µg)

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

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

Where:

$m_{total-B}$	= total amount of mercury in blank	=	0.9431	µg
$m_{total-S}$	= total amount of mercury in sample	=	29.1534	µg
0.05 x $m_{total-S}$	= 5% of $m_{total-S}$	=	1.4577	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	=	0.9431	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	=	29.1534	µg
$m_{T-B-allow}$	= total allowable blank correction	=	0.9431	µg
m_n	= total mercury in sample corrected for allowable blank	=	28.2104	µg

EPA Method 29 Sample Calculations - Mercury Emissions Results

Sample data taken from Run 1

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 throughtout. The final table is formatted to an appropriate number of significant figures.

121602 150715

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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	7.3045E-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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= Mercury concentration (µg/dscm)	=	1.1697E+01	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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	1.1697E-02	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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	1.2553E+01	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)	=	7.3045E-10	lb/dscf
x	= oxygen content of corrected gas (%)	=	7.0	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	11.2	%
20.9	= oxygen content of ambient air (%)	=	20.9	%
C_{sdx}	= Mercury concentration corrected to x% oxygen (lb/dscf)	=	1.0467E-09	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)	=	7.3045E-10	lb/dscf
y	= carbon dioxide content of corrected gas (%)	=	12.0	%
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	8.1	%
C_{sdy}	= Mercury conc. corrected to y% carbon dioxide (lb/dscf)	=	1.0777E-09	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)	=	7.3045E-10	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	101,636	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	190,450	acfm
C_a	= Mercury concentration at actual gas conditions (lb/acf)	=	3.8982E-10	lb/acf

8. Mercury emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205\times10^{-3}}{10^6}\right)(Q_{std})(60)$$

Where:

m_n	= Mercury collected in sample (total µg)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	101,636	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= Mercury emission rate (lb/hr)	=	4.4544E-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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	101,636	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)	=	5.6115E-04	g/s

10. Mercury emission rate (Ton/yr)

$$E_{T/yr} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205\times10^{-3}}{10^6}\right)(Q_{std})(60)\left(\frac{Cap}{2000}\right)$$

Where:

m_n	= Mercury collected in sample (total µg)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	101,636	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)	=	1.9510E-02	Ton/yr

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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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 (%)	=	11.2	%
20.9	= oxygen content of ambient air (%)	=	20.9	%
E_{Fd}	= Mercury emission rate - Fd-based (lb/MMBtu)	=	1.5062E-05	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)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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 (%)	=	8.1	%
100	= conversion factor	=	100	
E_{Fc}	= Mercury emission rate - Fc-based (lb/MMBtu)	=	1.6345E-05	lb/MMBtu

13. Mercury emission rate - Heat Input-based (lb/MMBtu)

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

Where:

m_n	= Mercury collected in sample (total µg)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	101,636	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
H_i	= actual heat input (MMBtu/hr)	=		MMBtu/hr
E_{Hi}	= Mercury emission rate - Heat Input-based (lb/MMBtu)	=	N/A	lb/MMBtu

14. Mercury Emission Rate - Production-based (lb/unit)

$$E_{RP} = \left(\frac{m_n}{V_{mstd}}\right)\left(\frac{2.205\times10^{-3}}{10^6}\right)\left(\frac{(Q_{std})(60)}{R_p}\right)$$

Where:

m_n	= Mercury collected in sample (total µg)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	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)	=	101,636	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
R_p	= production rate (units/hr)	=	184	units/hour
E_{RP}	= Mercury emission rate - production-based (lb/xxxxx)	=	2.4147E-05	lb/unit

15. Mercury Emission Rate - Production-based (g/unit)

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

Where:

m_n	= Mercury collected in sample (total µg)	=	28.2104	µg
V_{mstd}	= volume metered, standard (dscf)	=	85.1579	dscf
10^6	= conversion factor (µg/g)	=	1.0E+06	µg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	101,636	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
R_p	= production rate (units/hr)	=	184	units/hour
E_{RP}	= Mercury emission rate - production-based (g/xxxxx)	=	1.0951E-02	g/unit

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

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

Where:

m_n	= total mercury in sample corrected for allowable blank	=	28.2104	µg
m_{1b-S}	= mercury amount in sample for Fraction 1b	=	4.1685	µg
m_{2b-S}	= mercury amount in sample for Fraction 2b	=	23.4945	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	=	1.4904	µg
$m_{total-S}$	= total amount of mercury in sample	=	29.1534	µg
m_{n-1b}	= mercury corrected for blank - prorated for Fraction 1b	=	4.0337	µg
m_{n-2b}	= mercury corrected for blank - prorated for Fraction 2b	=	22.7345	µg
m_{n-3a}	= mercury corrected for blank - prorated for Fraction 3a	=	0.0000	µg
m_{n-3b}	= mercury corrected for blank - prorated for Fraction 3b	=	0.0000	µg
m_{n-3c}	= mercury corrected for blank - prorated for Fraction 3c	=	1.4422	µg

LOGIC FOR TREATING DETECTION LIMITS

(mercury only)

1. Logic for Determining Total Blank ($m_{Total\text{-}B}$) 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	$m_{Total\text{-}B}$ = Sum D, 1-5	$m_{Total\text{-}B}$ = Sum D	$m_{Total\text{-}B}$ = < Sum ND
ND=1x	$m_{Total\text{-}B}$ = Sum D, 1-5	$m_{Total\text{-}B}$ = Sum D	$m_{Total\text{-}B}$ = < Sum ND
ND=0.5x	$m_{Total\text{-}B}$ = Sum D, 1-5	$m_{Total\text{-}B}$ = Sum D	$m_{Total\text{-}B}$ = < 0.5 Sum ND

2. Logic for Determining Total Sample ($m_{Total\text{-}S}$) 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	$m_{Total\text{-}S}$ = Sum D, 1-5	$m_{Total\text{-}S}$ = Sum D	$m_{Total\text{-}S}$ = < Sum ND
ND=1x	$m_{Total\text{-}S}$ = Sum D, 1-5	$m_{Total\text{-}S}$ = < [Sum D + Sum ND]	$m_{Total\text{-}S}$ = < Sum ND
ND=0.5x	$m_{Total\text{-}S}$ = Sum D, 1-5	$m_{Total\text{-}S}$ = < [SumD+0.5 SumND]	$m_{Total\text{-}S}$ = < 0.5 Sum ND

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

	CASE 1 All 5 fractions are D. $m_{Total\text{-}B}$ = D	CASE 2 1 to 4 sample fractions are ND $m_{Total\text{-}B}$ = D	CASE 3 All 5 fractions are ND $m_{Total\text{-}B}$ = D	CASE 4 Any type of fractions $m_{Total\text{-}B}$ = ND
Rule				
ND = 0	$m_{T\text{-}B\text{-}allow}$ = M29 Rule	$m_{T\text{-}B\text{-}allow}$ = M29 Rule*	$m_{T\text{-}B\text{-}allow}$ = 0	$m_{T\text{-}B\text{-}allow}$ = 0
ND=1x	$m_{T\text{-}B\text{-}allow}$ = M29 Rule	$m_{T\text{-}B\text{-}allow}$ = M29 Rule*	$m_{T\text{-}B\text{-}allow}$ = 0	$m_{T\text{-}B\text{-}allow}$ = 0
ND=0.5x	$m_{T\text{-}B\text{-}allow}$ = M29 Rule	$m_{T\text{-}B\text{-}allow}$ = M29 Rule*	$m_{T\text{-}B\text{-}allow}$ = 0	$m_{T\text{-}B\text{-}allow}$ = 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. $m_{Total\text{-}S}$ - $m_{T\text{-}B\text{-}allow} \geq$ MIN(MDL)	CASE 2 1 to 4 sample fractions are ND $m_{Total\text{-}S}$ - $m_{T\text{-}B\text{-}allow} \geq$ MIN(MDL)	CASE 3 All 5 fractions are ND $m_{Total\text{-}S}$ and $m_{T\text{-}B\text{-}allow}$ anything	CASE 4 Any type of fractions $m_{Total\text{-}S}$ - $m_{T\text{-}B\text{-}allow}$ < MIN(MDL)
Rule				
ND = 0	$m_n = m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$	$m_n = m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$	m_n = < $m_{Total\text{-}S}$	m_n = < MIN[MDL]
ND=1x	$m_n = m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$	m_n = < [$m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$]	m_n = < $m_{Total\text{-}S}$	m_n = < MIN[MDL]
ND=0.5x	$m_n = m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$	m_n = < [$m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$]	m_n = < $m_{Total\text{-}S}$	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.

Prepared by Clean Air Engineering Proprietary Software
SS Metals-1 Version 10-2002

PARAMETERS

B

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

USEPA Method 29
Sampling, Velocity and Moisture Parameters

Run No.		1	2	3	Average
Date (2002)		December 3	December 3	December 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Sampling Conditions					
Y_d	Dry gas meter correction factor	0.9956	0.9956	0.9956	
C_p	Pitot tube coefficient	0.84	0.84	0.84	
P_g	Static pressure (in. H_2O)	-12.7000	-13.4000	-13.3000	
A_s	Sample location area (ft^2)	64.0000	64.0000	64.0000	
P_{bar}	Barometric pressure (in. Hg)	30.10	30.10	30.10	**30.1000**
D_n	Nozzle diameter (in.)	0.2800	0.2800	0.2800	
O_2	Oxygen (dry volume %)	11.2000	11.0667	9.7333	**10.6667**
CO_2	Carbon dioxide (dry volume %)	8.1333	8.6667	8.8667	**8.5556**
N_2+CO	Nitrogen plus carbon monoxide (dry volume %)	80.6667	80.2667	81.4000	**80.7778**
V_{lc}	Total Liquid collected (ml)	467.90	459.80	470.80	
V_m	Volume metered, meter conditions (ft^3)	85.7340	81.9500	88.8080	
T_m	Dry gas meter temperature (°F)	77.7000	87.7400	88.8400	
T_s	Sample temperature (°F)	306.2800	307.1200	304.6000	**306.0000**
ΔH	Meter box orifice pressure drop (in. H_2O)	1.4220	1.3920	1.4912	
θ	Total sampling time (min)	125.0	125.0	125.0	
Flow Results					
V_{wstd}	Volume of water collected (ft^3)	22.0241	21.6428	22.1606	**21.9425**
V_{mstd}	Volume metered, standard (dscf)	84.5803	79.3595	85.8490	**83.2629**
P_s	Sample gas pressure, absolute (in. Hg)	29.1662	29.1147	29.1221	**29.1343**
P_v	Vapor pressure, actual (in. Hg)	29.1662	29.1147	29.1221	**29.1343**
B_{wo}	Moisture measured in sample (% by volume)	20.6596	21.4280	20.5172	**20.8683**
B_{ws}	Saturated moisture content (% by volume)	100.0000	100.0000	100.0000	**100.0000**
B_w	Actual water vapor in gas (% by volume)	20.6596	21.4280	20.5172	**20.8683**
$\sqrt{\Delta P}$	Velocity head ($\sqrt{in.}$ H_2O)	0.7045	0.6897	0.7204	**0.7048**
M_d	MW of sample gas, dry (lb/lb-mole)	29.7493	29.8293	29.8080	**29.7956**
M_s	MW of sample gas, wet (lb/lb-mole)	27.3220	27.2945	27.3853	**27.3339**
V_s	Velocity of sample (ft/sec)	49.6082	48.6597	50.6509	**49.6396**
%I	Isokinetic sampling (%)	99.8178	96.6920	98.9842	**98.4980**
Q_a	Volumetric flow rate, actual (acfm)	190,495	186,853	194,499	**190,616**
Q_s	Volumetric flow rate, standard (scfm)	127,952	125,148	130,731	**127,944**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	101,518	98,331	103,909	**101,253**
Q_{std7}	Volumetric flow rate, dry std@7%O_2 (dscfm)	70,843	69,563	83,476	**74,627**
Q_a	Volumetric flow rate, actual (acf/hr)	11,429,719	11,211,205	11,669,966	**11,436,963**
Q_s	Volumetric flow rate, standard (scf/hr)	7,677,148	7,508,855	7,843,858	**7,676,620**
Q_{std}	Volumetric flow rate, dry standard (dscf/hr)	6,091,078	5,899,856	6,234,517	**6,075,150**
Q_a	Volumetric flow rate, actual (m^3/hr)	323,696	317,508	330,500	**323,902**
Q_s	Volumetric flow rate, standard (m^3/hr)	217,421	212,655	222,143	**217,406**
Q_{std}	Volumetric flow rate, dry standard (dry m^3/hr)	172,503	167,087	176,565	**172,052**
Q_{std7}	Volumetric flow rate, dry std@7%O_2 (dry m^3/hr)	120,380	118,203	141,845	**126,809**
Q_s	Volumetric flow rate, normal (Nm^3/hr)	202,597	198,156	206,997	**202,583**
Q_{std}	Volumetric flow rate, dry normal (Nm^3/hr)	160,741	155,695	164,527	**160,321**
Q_{std7}	Volumetric flow rate, dry normal @7%O_2 (Nm^3/hr)	112,172	110,144	132,174	**118,163**

Comments:

None

121602 135720

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

USEPA Method 29
Mercury (Hg) Laboratory Parameters

Blank Analysis				
m_{1b-B}	Fraction 1B Blank (µg)	<0.1000		
m_{2b-B}	Fraction 2B Blank (µg)	<0.3000		
m_{3a-B}	Fraction 3A Blank (µg)	<0.2000		
m_{3b-B}	Fraction 3B Blank (µg)	<0.4000		
m_{3c-B}	Fraction 3C Blank (µg)	0.9431		
$m_{total-B}$	Total Blank Amount (ND counted as zero) (µg)	0.9431		
Run No.		**1**	**2**	**3**
Date (2002)		Dec 3	Dec 3	Dec 3
Start Time (approx.)		07:47	09:59	12:10
Stop Time (approx.)		09:58	12:09	16:21
Sample Analysis				
m_{1b-S}	Fraction 1B Sample (µg)	4.1685	5.6185	5.2809
m_{2b-S}	Fraction 2B Sample (µg)	23.4945	19.8268	36.6612
m_{3a-S}	Fraction 3A Sample (µg)	<0.2000	<0.2000	<0.2000
m_{3b-S}	Fraction 3B Sample (µg)	<0.5000	<0.5000	<0.5000
m_{3c-S}	Fraction 3C Sample (µg)	1.4904	1.6832	1.3938
$m_{total-S}$	Total Sample Amount (µg)	29.1534	27.1284	43.3358
Allowable Blank				
$m_{T-B-allow}$	Total Allowable Blank (µg)	0.9431	0.9431	0.9431
Sample Corrected for Blank				
m_n	Total Sample Amount (µg)	28.2104	26.1853	42.3927
Sample Corrected for Blank - Prorated Fractions				
m_{n-1b}	Fraction 1B Prorated (µg)	4.0337	5.4231	5.1659
m_{n-2b}	Fraction 2B Prorated (µg)	22.7345	19.1375	35.8634
m_{n-3a}	Fraction 3A Prorated (µg)	0.0000	0.0000	0.0000
m_{n-3b}	Fraction 3B Prorated (µg)	0.0000	0.0000	0.0000
m_{n-3c}	Fraction 3C Prorated (µg)	1.4422	1.6247	1.3634

121602 135720

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

USEPA Method 29
Mercury (Hg) Emission Parameters

Run No.		1	2	3	Average
Date (2002)		Dec 3	Dec 3	Dec 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Process Conditions					
R_p	Steam Flow - (Klbs/hour)	184.4700	184.8800	185.8000	**185.0500**
P_1	Fabric Filter Inlet Temperature (°F)	320.1100	320.0300	319.0000	**319.7133**
F_d	Oxygen-based F-factor (dscf/MMBtu)	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**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	11.2000	11.0667	9.7333	**10.6667**
CO_2	Carbon dioxide (dry volume %)	8.1333	8.6667	8.8667	**8.5556**
T_s	Sample temperature (°F)	306.2800	307.1200	304.6000	**306.0000**
B_w	Actual water vapor in gas (% by volume)	20.5483	21.4280	20.4064	**20.7942**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	190,450	186,853	194,453	**190,585**
Q_s	Volumetric flow rate, standard (scfm)	127,922	125,148	130,700	**127,923**
Q_{sd}	Volumetric flow rate, dry standard (dscfm)	101,636	98,331	104,029	**101,332**
Q_{sd7}	Volumetric flow rate, dry std@7%O_2 (dscfm)	70,926	69,563	83,572	**74,687**
Q_a	Volumetric flow rate, actual (acf/hr)	11,426,984	11,211,205	11,667,180	**11,435,123**
Q_s	Volumetric flow rate, standard (scf/hr)	7,675,310	7,508,855	7,841,985	**7,675,384**
Q_{sd}	Volumetric flow rate, dry standard (dscf/hr)	6,098,167	5,899,856	6,241,716	**6,079,913**
Q_a	Volumetric flow rate, actual (m^3/hr)	323,619	317,508	330,421	**323,849**
Q_s	Volumetric flow rate, standard (m^3/hr)	217,369	212,655	222,090	**217,371**
Q_{sd}	Volumetric flow rate, dry standard (dry m^3/hr)	172,704	167,087	176,769	**172,187**
Q_{sd7}	Volumetric flow rate, dry std@7%O_2 (dry m^3/hr)	120,520	118,203	142,009	**126,911**
Q_s	Volumetric flow rate, normal (Nm^3/hr)	202,549	198,156	206,947	**202,551**
Q_{sd}	Volumetric flow rate, dry normal (Nm^3/hr)	160,928	155,695	164,717	**160,447**
Q_{sd7}	Volumetric flow rate, dry normal @7%O_2 (Nm^3/hr)	112,303	110,144	132,326	**118,258**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	85.1579	79.3595	86.4354	**83.6509**
%I	Isokinetic sampling (%)	100.3827	96.6920	99.5453	**98.8733**
Laboratory Data					
m_{n-1b}	Fraction 1B Prorated (µg)	4.0337	5.4231	5.1659	**4.8743**
m_{n-2b}	Fraction 2B Prorated (µg)	22.7345	19.1375	35.8634	**25.9118**
m_{n-3a}	Fraction 3A Prorated (µg)	0.0000	0.0000	0.0000	**0.0000**
m_{n-3b}	Fraction 3B Prorated (µg)	0.0000	0.0000	0.0000	**0.0000**
m_{n-3c}	Fraction 3C Prorated (µg)	1.4422	1.6247	1.3634	**1.4768**
m_n	Total matter corrected for allowable blanks (µg)	28.2104	26.1853	42.3927	**32.2628**
Mercury Results - Total					
C_{sd}	Concentration (lb/dscf)	7.3045E-10	7.2756E-10	1.0815E-09	**8.4649E-10**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	1.0467E-09	1.0284E-09	1.3462E-09	**1.1404E-09**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	1.0777E-09	1.0074E-09	1.4636E-09	**1.1829E-09**
C_a	Concentration (lb/acf)	3.8982E-10	3.8288E-10	5.7856E-10	**4.5042E-10**
C_{sd}	Concentration (µg/dscm)	1.1697E+01	1.1651E+01	1.7318E+01	**1.3555E+01**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	1.6762E+01	1.6469E+01	2.1557E+01	**1.8263E+01**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	1.7258E+01	1.6132E+01	2.3438E+01	**1.8943E+01**
C_{sd}	Concentration (mg/dscm)	1.1697E-02	1.1651E-02	1.7318E-02	**1.3555E-02**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	1.6762E-02	1.6469E-02	2.1557E-02	**1.8263E-02**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	1.7258E-02	1.6132E-02	2.3438E-02	**1.8943E-02**
C_a	Concentration (µg/m^3 (actual,wet))	6.2424E+00	6.1312E+00	9.2648E+00	**7.2128E+00**
C_{sd}	Concentration (µg/Nm^3 dry)	1.2553E+01	1.2503E+01	1.8585E+01	**1.4547E+01**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	1.7988E+01	1.7674E+01	2.3134E+01	**1.9599E+01**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	1.8521E+01	1.7312E+01	2.5153E+01	**2.0329E+01**
$E_{lb/hr}$	Rate (lb/hr)	4.4544E-03	4.2925E-03	6.7501E-03	**5.1657E-03**
$E_{g/s}$	Rate (g/s)	5.6115E-04	5.4075E-04	8.5036E-04	**6.5075E-04**
$E_{T/yr}$	Rate (Ton/yr)	1.9510E-02	1.8801E-02	2.9566E-02	**2.2626E-02**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	1.5062E-05	1.4799E-05	1.9371E-05	**1.6410E-05**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	1.6345E-05	1.5279E-05	2.2198E-05	**1.7941E-05**

121602 153159

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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

Run No.		1	2	3	Average
Date (2002)		Dec 3	Dec 3	Dec 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Mercury Results - Front Half					
C_{sd}	Concentration (lb/dscf)	1.0444E-10	1.5068E-10	1.3179E-10	**1.2897E-10**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	1.4967E-10	2.1300E-10	1.6404E-10	**1.7557E-10**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	1.5410E-10	2.0864E-10	1.7836E-10	**1.8036E-10**
C_a	Concentration (lb/acf)	5.5738E-11	7.9296E-11	7.0502E-11	**6.8512E-11**
C_{sd}	Concentration (µg/dscm)	1.6725E+00	2.4130E+00	2.1104E+00	**2.0653E+00**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	2.3967E+00	3.4109E+00	2.6269E+00	**2.8115E+00**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	2.4677E+00	3.3410E+00	2.8561E+00	**2.8883E+00**
C_{sd}	Concentration (mg/dscm)	1.6725E-03	2.4130E-03	2.1104E-03	**2.0653E-03**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	2.3967E-03	3.4109E-03	2.6269E-03	**2.8115E-03**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	2.4677E-03	3.3410E-03	2.8561E-03	**2.8883E-03**
C_a	Concentration (µg/m³ (actual,wet))	8.9257E-01	1.2698E+00	1.1290E+00	**1.0971E+00**
C_{sd}	Concentration (µg/Nm³ dry)	1.7949E+00	2.5895E+00	2.2648E+00	**2.2164E+00**
C_{sd7}	Concentration @7% O_2 (µg/Nm³ dry)	2.5721E+00	3.6604E+00	2.8191E+00	**3.0172E+00**
C_{sd12}	Concentration @12% CO_2 (µg/Nm³ dry)	2.6482E+00	3.5855E+00	3.0651E+00	**3.0996E+00**
$E_{lb/hr}$	Rate (lb/hr)	6.3692E-04	8.8900E-04	8.2257E-04	**7.8283E-04**
$E_{g/s}$	Rate (g/s)	8.0237E-05	1.1199E-04	1.0362E-04	**9.8618E-05**
E_{Tyr}	Rate (Ton/yr)	2.7897E-03	3.8938E-03	3.6028E-03	**3.4288E-03**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	2.1536E-06	3.0649E-06	2.3605E-06	**2.5263E-06**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	2.3372E-06	3.1643E-06	2.7051E-06	**2.7355E-06**
E_{Hi}	Rate - Heat Input-based (lb/MMBtu)	N/A	N/A	N/A	
E_{Rp}	Rate - Production-based (lb/xxxxx)	3.4527E-06	4.8085E-06	4.4272E-06	**4.2295E-06**
E_{Rp}	Rate - Production-based (g/xxxxx)	1.5659E-03	2.1807E-03	2.0078E-03	**1.9181E-03**

121602 153159

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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

Run No.		1	2	3	Average
Date (2002)		Dec 3	Dec 3	Dec 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Mercury Results - Impingers 1-3 Solution					
C_{sd}	Concentration (lb/dscf)	5.8867E-10	5.3173E-10	9.1489E-10	**6.7843E-10**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	8.4355E-10	7.5164E-10	1.1388E-09	**9.1134E-10**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	8.6852E-10	7.3625E-10	1.2382E-09	**9.4766E-10**
C_a	Concentration (lb/acf)	3.1415E-10	2.7982E-10	4.8945E-10	**3.6114E-10**
C_{sd}	Concentration (µg/dscm)	9.4267E+00	8.5150E+00	1.4651E+01	**1.0864E+01**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	1.3508E+01	1.2036E+01	1.8237E+01	**1.4594E+01**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	1.3908E+01	1.1790E+01	1.9828E+01	**1.5175E+01**
C_{sd}	Concentration (mg/dscm)	9.4267E-03	8.5150E-03	1.4651E-02	**1.0864E-02**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	1.3508E-02	1.2036E-02	1.8237E-02	**1.4594E-02**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	1.3908E-02	1.1790E-02	1.9828E-02	**1.5175E-02**
C_a	Concentration (µg/m³ (actual,wet))	5.0307E+00	4.4810E+00	7.8378E+00	**5.7832E+00**
C_{sd}	Concentration (µg/Nm³ dry)	1.0116E+01	9.1380E+00	1.5723E+01	**1.1659E+01**
C_{sd7}	Concentration @7% O_2 (µg/Nm³ dry)	1.4497E+01	1.2917E+01	1.9571E+01	**1.5662E+01**
C_{sd12}	Concentration @12% CO_2 (µg/Nm³ dry)	1.4926E+01	1.2653E+01	2.1279E+01	**1.6286E+01**
$E_{lb/hr}$	Rate (lb/hr)	3.5898E-03	3.1372E-03	5.7105E-03	**4.1458E-03**
$E_{g/s}$	Rate (g/s)	4.5223E-04	3.9521E-04	7.1938E-04	**5.2227E-04**
$E_{T/yr}$	Rate (Ton/yr)	1.5723E-02	1.3741E-02	2.5012E-02	**1.8159E-02**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	1.2138E-05	1.0816E-05	1.6387E-05	**1.3114E-05**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	1.3173E-05	1.1166E-05	1.8779E-05	**1.4373E-05**
E_{Hi}	Rate - Heat Input-based (lb/MMBtu)	N/A	N/A	N/A	
E_{Rp}	Rate - Production-based (lb/xxxxx)	1.9460E-05	1.6969E-05	3.0735E-05	**2.2388E-05**
E_{Rp}	Rate - Production-based (g/xxxxx)	8.8254E-03	7.6955E-03	1.3939E-02	**1.0153E-02**

121602 153159

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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

Run No.		1	2	3	Average
Date (2002)		Dec 3	Dec 3	Dec 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Mercury Results - Impinger 4 Solution					
C_{sd}	Concentration (lb/dscf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_a	Concentration (lb/acf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd}	Concentration (µg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd}	Concentration (mg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_a	Concentration (µg/m^3 (actual,wet))	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd}	Concentration (µg/Nm^3 dry)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (µg/Nm^3 dry)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (µg/Nm^3 dry)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
$E_{lb/hr}$	Rate (lb/hr)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
$E_{g/s}$	Rate (g/s)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
$E_{T/yr}$	Rate (Ton/yr)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Hs}	Rate - Heat Input-based (lb/MMBtu)	N/A	N/A	N/A	
E_{Rp}	Rate - Production-based (lb/xxxxx)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Rp}	Rate - Production-based (g/xxxxx)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**

121602 153159

QA/QC _____
Date _____

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

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

Run No.		1	2	3	Average
Date (2002)		Dec 3	Dec 3	Dec 3	
Start Time (approx.)		07:47	09:59	12:10	
Stop Time (approx.)		09:58	12:09	16:21	
Mercury Results - Filtered Permanganate Solution					
C_{sd}	Concentration (lb/dscf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_a	Concentration (lb/acf)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd}	Concentration (µg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd}	Concentration (mg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_a	Concentration (µg/m³ (actual,wet))	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd}	Concentration (µg/Nm³ dry)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd7}	Concentration @7% O_2 (µg/Nm³ dry)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
C_{sd12}	Concentration @12% CO_2 (µg/Nm³ dry)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
$E_{lb/hr}$	Rate (lb/hr)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
$E_{g/s}$	Rate (g/s)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
$E_{T/yr}$	Rate (Ton/yr)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Hi}	Rate - Heat Input-based (lb/MMBtu)	N/A	N/A	N/A	
E_{Rp}	Rate - Production-based (lb/xxxxx)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
E_{Rp}	Rate - Production-based (g/xxxxx)	0.0000E+00	0.0000E+00	0.0000E+00	**0.0000E+00**
Mercury Results - HCl Rinse + HCl/MnO2 Precipitate					
C_{sd}	Concentration (lb/dscf)	3.7342E-11	4.5142E-11	3.4781E-11	**3.9089E-11**
C_{sd7}	Concentration @7% O_2 (lb/dscf)	5.3511E-11	6.3811E-11	4.3295E-11	**5.3539E-11**
C_{sd12}	Concentration @12% CO_2 (lb/dscf)	5.5095E-11	6.2504E-11	4.7073E-11	**5.4891E-11**
C_a	Concentration (lb/acf)	1.9928E-11	2.3756E-11	1.8607E-11	**2.0764E-11**
C_{sd}	Concentration (µg/dscm)	5.9798E-01	7.2289E-01	5.5698E-01	**6.2595E-01**
C_{sd7}	Concentration @7% O_2 (µg/dscm)	8.5690E-01	1.0218E+00	6.9331E-01	**8.5735E-01**
C_{sd12}	Concentration @12% CO_2 (µg/dscm)	8.8227E-01	1.0009E+00	7.5380E-01	**8.7900E-01**
C_{sd}	Concentration (mg/dscm)	5.9798E-04	7.2289E-04	5.5698E-04	**6.2595E-04**
C_{sd7}	Concentration @7% O_2 (mg/dscm)	8.5690E-04	1.0218E-03	6.9331E-04	**8.5735E-04**
C_{sd12}	Concentration @12% CO_2 (mg/dscm)	8.8227E-04	1.0009E-03	7.5380E-04	**8.7900E-04**
C_a	Concentration (µg/m³ (actual,wet))	3.1912E-01	3.8042E-01	2.9797E-01	**3.3250E-01**
C_{sd}	Concentration (µg/Nm³ dry)	6.4174E-01	7.7578E-01	5.9773E-01	**6.7175E-01**
C_{sd7}	Concentration @7% O_2 (µg/Nm³ dry)	9.1960E-01	1.0966E+00	7.4404E-01	**9.2008E-01**
C_{sd12}	Concentration @12% CO_2 (µg/Nm³ dry)	9.4682E-01	1.0742E+00	8.0896E-01	**9.4331E-01**
$E_{lb/hr}$	Rate (lb/hr)	2.2772E-04	2.6633E-04	2.1710E-04	**2.3705E-04**
$E_{g/s}$	Rate (g/s)	2.8687E-05	3.3552E-05	2.7349E-05	**2.9863E-05**
$E_{T/yr}$	Rate (Ton/yr)	9.9741E-04	1.1665E-03	9.5088E-04	**1.0383E-03**
E_{Fd}	Rate - Fd-based (lb/MMBtu)	7.6999E-07	9.1820E-07	6.2299E-07	**7.7039E-07**
E_{Fc}	Rate - Fc-based (lb/MMBtu)	8.3561E-07	9.4798E-07	7.1393E-07	**8.3251E-07**
E_{Hi}	Rate - Heat Input-based (lb/MMBtu)	N/A	N/A	N/A	
E_{Rp}	Rate - Production-based (lb/xxxxx)	1.2344E-06	1.4406E-06	1.1684E-06	**1.2811E-06**
E_{Rp}	Rate - Production-based (g/xxxxx)	5.5984E-04	6.5332E-04	5.2990E-04	**5.8102E-04**

121602 153159

QA/QC _____
Date _____

CALIBRATION DATA

C

Nozzle Calibration Sheet

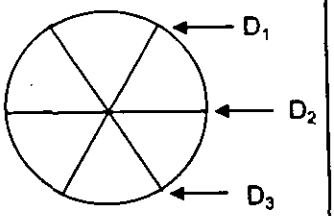
Client Wheelabrator N. Broward	Project Number 9156
Calibrated by K. OHalloren	Unit 3 FF Outlet
Date 12/2/2002	Runs 6 (1-4)

Nozzle Identification	D_1 (inches)	D_2 (inches)	D_3 (inches)	ΔD (inches)	ΔD_{ave} (inches)
FF Outlet #1	0.280	0.280	0.280	0	0.280
FF Outlet #2	0.281	0.280	0.280	0.001	0.280

D_1, D_2, D_3 = three nozzle diameter measurements

ΔD = maximum difference between any two diameters
$\Delta D \leq 0.004$ inches*

ΔD_{ave} = average of D_1, D_2, D_3



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

QA/QC_____
Date_____

CleanAir ENGINEERING

Meter Box Full Test Calibration

Meter Box No: 66-10

Date of Calibration: 10/24/2001

Meter Box Y_d: 1.0024

Calibration conducted by: R.R.

Meter Box ?H@: 1.6830

Barometric Pressure: 28.83

Signature

				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	?H	?P	Y_{ds}	Initial	Final	V_{ds} Net	Initial	Final	V_d Net	In	Out	T_{ds} Avg.	In	T_o Out	T_d Avg.	Θ	Y_d	?H@
0.973	3.00	-1.80	1.0000	0.000	10.000	10.000	406.142	416.224	10.082	70.0	70.0	70.00	86.0	78.0	82.00	9.86	1.0020	1.6850
0.973	3.00	-1.80	1.0000	0.000	10.000	10.000	416.224	426.307	10.083	70.0	70.0	70.00	86.0	78.0	82.00	9.86	1.0019	1.6850
0.394	0.50	-1.10	1.0000	0.000	5.000	5.000	438.167	443.211	5.044	70.0	70.0	70.00	80.0	77.0	78.50	12.18	1.0031	1.7173
0.394	0.50	-1.10	1.0000	0.000	5.000	5.000	443.211	448.255	5.044	70.0	70.0	70.00	81.0	78.0	79.50	12.19	1.0049	1.7169
0.696	1.50	-1.40	1.0000	0.000	10.000	10.000	452.329	462.435	10.106	70.0	70.0	70.00	84.0	77.0	80.50	13.78	1.0017	1.6486
0.696	1.50	-1.40	1.0000	0.000	10.000	10.000	462.435	472.560	10.125	70.0	70.0	70.00	84.0	78.0	81.00	13.78	1.0007	1.6455

Averages 1.00238 1.68305

Nomenclature

- P_b Barometric Pressure (in. Hg)
- Q Flow Rate (cfm)
- ?H Orifice Pressure differential (in. H_2O)
- ?P 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_{ds} Standard Meter Correction Factor (unitless)
- ?H@ Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 In. Hg (in. H_2O)
- Θ Duration of Run (minutes)

Equations

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

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

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

Vacuum Gauge		DGM Thermocouples		
Standard (In.Hg)	Gauge (In.Hg)	Standard (°F)	Inlet (°F)	Outlet (°F)
5.5	5.0			
10.5	10.0			
15.5	15.0			
20.5	20.0			
24.5	24.0			

CleanAir ENGINEERING

Pyrometer Calibration Test Report

Pyrometer No.:	66-10	Office:	Palatine, Il
Calibrated By:	R.R.	Client:	
Date:	10/24/2001	Job Number:	

Calibration Reference Settings for Fahrenheit Scale	Pyrometer Reading
50 °F	51 °F
100 °F	100 °F
150 °F	150 °F
200 °F	201 °F
250 °F	252 °F
300 °F	301 °F
350 °F	351 °F
400 °F	400 °F
450 °F	449 °F
500 °F	499 °F
550 °F	549 °F
600 °F	600 °F

Calibration Reference Information

Reference Used:	Omega CL23A	Serial No:	T-225950
Calibrated By:	Omega Engineering, Inc.	Date:	3/15/2001
Report No:	RF-T-225950		

CleanAir ENGINEERING

Meter Box Critical Orifice Post-Test Calibration Data

Project No.	9156/9157	Meter No.	66-10	Orifice	66-N-2
Location	Unit 3 FF Outlet	Meter Yd	1.0024	Orifice K'	0.3890
Test Date	12/6/2002	Meter ΔH@	1.6830	Orifice Cal. Date	10/15/2002
Operator	M. Ambler	Full Test Cal. Date	10/17/2002		

Leak Checks

Negative Pressure

No movement of manometer in one-minute ☑ Pass

Positive Pressure

No movement of manometer in one-minute ☑ Pass

Important: All leak checks must pass in order for calibration to be valid.

Barom. Press. (P_b) 30.00 *in. Hg*

Run	Elapsed Time (minutes)	Meter Volume (dcf)	Meter Temperature		Ambient Temp. T_{amb} (°F)	Orifice ΔH (in. W.C.)	Vacuum (in. Hg)	Net Run Time - θ (minutes)	Net Meter Volume for Run - V_m (dcf)	Avg Meter Temp. for Run - T_m (°F)	DGM Calibration Factor - Y_i	Percent Variation - ΔY
			Inlet (°F)	Outlet (°F)								
	0.0	786.30	89	87								
1	5.0	788.92	89	87	84	0.79	21.5	5.0	2.62	88.0	0.9869	-0.2%
2	10.0	791.54	87	86	82	0.79	21.5	5.0	2.62	87.3	0.9873	-0.1%
3	15.0	794.15	87	86	80	0.79	21.5	5.0	2.61	86.5	0.9916	0.3%
										Average Y_i	0.9886	
										Cal. Error	-1.4%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times \left(P_b + \Delta H / 13.6\right) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \overline{Y}_i}{\overline{Y}_i} \times 100 \qquad \text{Spec.: } \Delta Y_i \le \pm 2\%$$

$$Cal.Error = \frac{\overline{Y}_i - Y_d}{Y_d} \times 100 \qquad \text{Spec.: } Cal.Error \le \pm 5\%$$

CleanAir ENGINEERING

Meter Box Full Test Calibration

Meter Box No: 66-13

Date of Calibration: 10/24/2002

Meter Box Y_d: 0.9956

Calibration conducted by: M.V.

Meter Box ?H@: 1.7701

Barometric Pressure: 29.68

Signature

				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	?H	?P	Y_{ds}	Initial	Final	V_{ds} Net	Initial	Final	V_d Net	In	Out	T_{ds} Avg.	In	T_o Out	T_d Avg.	Θ	Y_d	?H@
0.968	3.00	-1.90	1.0000	0.000	10.000	10.000	493.734	503.874	10.140	67.5	67.5	67.50	89.0	72.0	80.50	10.25	0.9983	1.7719
0.967	3.00	-1.90	1.0000	0.000	10.000	10.000	503.874	514.046	10.172	67.5	67.5	67.50	90.0	72.0	81.00	10.26	0.9961	1.7753
0.394	0.50	-1.10	1.0000	0.000	5.000	5.000	517.929	523.003	5.074	67.5	67.5	67.50	81.0	70.0	75.50	12.61	0.9964	1.7946
0.394	0.50	-1.10	1.0000	0.000	5.000	5.000	523.003	528.087	5.084	67.5	67.5	67.50	81.0	70.0	75.50	12.61	0.9944	1.7946
0.692	1.50	-1.40	1.0000	0.000	10.500	10.500	535.628	546.324	10.696	67.5	67.5	67.50	86.0	70.0	78.00	15.06	0.9940	1.7412
0.692	1.50	-1.40	1.0000	0.000	10.000	10.000	546.324	556.509	10.185	67.5	67.5	67.50	86.0	70.0	78.00	14.35	0.9942	1.7430

Averages 0.99559 1.77008

Nomenclature

- P_b Barometric Pressure (in. Hg)
- Q Flow Rate (cfm)
- ?H Orifice Pressure differential (in. H_2O)
- ?P 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_{ds} Standard Meter Correction Factor (unitless)
- ?H@ Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 in. Hg (in. H_2O)
- Θ Duration of Run (minutes)

Equations

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

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

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

Vacuum Gauge		DGM Thermocouples		
Standard (in:Hg)	Gauge (in.Hg)	Standard (°F)	Inlet (°F)	Outlet (°F)
5.0	5.2			
10.0	10.2			
15.0	15.3			
20.0	20.3			
25.0	25.0			

CleanAir ENGINEERING

Pyrometer Calibration Test Report

Pyrometer No.:	66-13	Office:	Palatine, Il
Calibrated By:	M.V.	Client:	
Date:	10/24/2002	Job Number:	

Calibration Reference Settings for Fahrenheit Scale	Pyrometer Reading
50 °F	48 °F
100 °F	98 °F
150 °F	148 °F
200 °F	199 °F
250 °F	250 °F
300 °F	300 °F
350 °F	349 °F
400 °F	398 °F
450 °F	448 °F
500 °F	498 °F
550 °F	548 °F
600 °F	599 °F

Calibration Reference Information

Reference Used:	Omega CL23A	Serial No:	T-225950
Calibrated By:	Omega Engineering, Inc.	Date:	8/28/2003
Report No:	R 044791		

CleanAir ENGINEERING

Meter Box Critical Orifice Post-Test Calibration Data

Project No.	9156/9157	Meter No.	66-13	Orifice	66-N-3
Location	Unit 3 FF Outlet	Meter Yd	0.9956	Orifice K'	0.5700
Test Date	12/6/2002	Meter ΔH@	1.7701	Orifice Cal. Date	10/15/2002
Operator	M. Ambler	Full Test Cal. Date	10/24/2002		

Leak Checks

Negative Pressure

No movement of manometer in one-minute ☑ Pass

Positive Pressure

No movement of manometer in one-minute ☑ Pass

Important: All leak checks must pass in order for calibration to be valid.

Barom. Press. (P_b) 30.00 in. Hg

Run	Elapsed Time (minutes)	Meter Volume (dcf)	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Ambient Temp. T_{amb} (°F)	Orifice ΔH (in. W.C.)	Vacuum (in. Hg)	Net Run Time, θ (minutes)	Net Meter Volume for Run, V_m (dcf)	Avg Meter Temp. for Run, T_m (°F)	DGM Calibration Factor, Y_i	Percent Variation, ΔY_i
	0.0	62.00	93	87								
1	5.0	65.82	93	87	84	1.80	19.5	5.0	3.82	90.0	0.9930	-0.1%
2	10.0	69.63	93	88	84	1.80	19.5	5.0	3.81	90.3	0.9960	0.2%
3	15.0	73.46	95	90	84	1.80	19.5	5.0	3.83	91.5	0.9931	-0.1%
										Average Y_i	0.9940	
										Cal. Error	-0.2%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times \left(P_b + \Delta H/13.6\right) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \overline{Y}_i}{\overline{Y}_i} \times 100 \qquad \text{Spec.: } \Delta Y_i \le \pm 2\%$$

$$Cal.Error = \frac{\overline{Y}_i - Y_d}{Y_d} \times 100 \qquad \text{Spec.: } Cal.Error \le \pm 5\%$$

CleanAir ENGINEERING

Sample Probe Calibration

Probe Type: 8' MS type S Pitot **I.D. Number:** 67-8-13

Thermocouple Calibration

Reference Type: _____ Reference I.D. No: _____ Pyrometer I.D. No: _____ Degrees:

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Specification
1	Ice-32F					
2	Ambient-70F					%Difference ≤ 1.5
3	Hot Oil-150F					
4	Boiling H_2O-212F					
5	Hot Oil-320F					

* Based on Absolute Temperature (Rankine)

Does assembly meet specifications?

Geometric Pitot Calibration

"S" Pitot

Measurement				Specification
α1(°)=	.000	α2(°)=	1.00	≤10°
β1(°)=	.000	β2(°)=	.000	≤05°
γ(°)=	1.00	θ(°)=	.000	
Pa(")=	.373	Pb(")=	.373	Pa + Pb = A
A(")=	.746	Dt(")=	.250	

Calculations

Z(")= A sin γ =	.0130	≤ 0.125"
W(")= A sin θ =	.000	≤ 0.03125"

Standard Pitot

Measurement (inches)		Specification
Tube O.D.		(D)
Static Hole I.D.		≈ 0.1 x (D)
Length:		
Tip to Static		≥ 6 x (D)
Static to Bend		≥ 8 x (D)

Does assembly meet specifications? yes → **If "Yes", "S" pitot Cp=0.84; Std. Pitot=0.99. If "No", wind tunnel calibration is required.**

Wind Tunnel Calibration

Reference Pitot I.D. No: _____ Reference Pitot Cp: _____

Pitot Side 'A':

Trial No.	Reference ΔP	Probe ΔP	Probe Cp*	Deviation from Average Cp*
1				
2				
3				

Side 'A' Average Probe Cp= _____ Specification: Cp Deviations ≤ 0.01

Pitot Side 'B':

Trial No.	Reference ΔP	Probe ΔP	Probe Cp*	Deviation from Average Cp*
1				
2				
3				

Side 'B' Average Probe Cp= _____ Specification: Cp Deviations ≤ 0.01

*Probe Cp= (Reference Cp)√(Reference ΔP/ Probe ΔP); Cp Deviation= Trial Cp - Average Probe Cp

'A' Average Cp		'B' Average Cp		Difference	
	—		=		|Difference| ≤ 0.01

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

All specifications are from ASME PTC 19.2-2010 Section 4

Probe Cp= 0.84 Calibrated by: M. Ambler Date: 2/18/02

Sample Probe Calibration

Probe Type: S-Ft. M5 **I.D. Number:** M-8-2

Thermocouple Calibration

Reference Type: _____ Reference I.D. No: _____ Pyrometer I.D. No: _____ Degrees:

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Specification
1	Ice-32F					
2	Ambient-70F					%Difference ≤ 1.5
3	Hot Oil-150F					
4	Boiling H_2O-212F					
5	Hot Oil-320F					

* Based on Absolute Temperature (Rankine)

Does assembly meet specifications?

Geometric Pitot Calibration

"S" Pitot

Measurement				Specification
α1(°)= 2	α2(°)= 1			≤10°
β1(°)= 1	β2(°)= 0			≤05°
γ(°)= 17	θ(°)= 2			
Pa(")= .360	Pb(")= .368			Pa + Pb = A
A(")= 0.728	Dt(")= .250			

Calculations

Z(")= A sin γ = 0.00000 ≤ 0.125"

W(")= A sin θ = 0.02541 ≤ 0.03125"

Standard Pitot

Measurement (Inches)		Specification
Tube O.D.		(D)
Static Hole I.D.		≈ 0.1 x (D)
Length:		
Tip to Static		≥ 6 x (D)
Static to Bend		≥ 8 x (D)

Does assembly meet specifications? yes → **If "Yes", "S" pitot Cp=0.84; Std. Pitot=0.99. If "No", wind tunnel calibration is required.**

Wind Tunnel Calibration

Reference Pitot I.D. No: _____ Reference Pitot Cp: _____

Pitot Side 'A':

Trial No.	Reference ΔP	Probe ΔP	Probe Cp*	Deviation from Average Cp*
1				
2				
3				
Side 'A' Average Probe Cp=				

Specification: Cp Deviations ≤ 0.01

Pitot Side 'B':

Trial No.	Reference ΔP	Probe ΔP	Probe Cp*	Deviation from Average Cp*
1				
2				
3				
Side 'B' Average Probe Cp=				

Specification: Cp Deviations ≤ 0.01

*Probe Cp= (Reference Cp)√(Reference ΔP/ Probe ΔP); Cp Deviation= Trial Cp - Average Probe Cp

'A' Average Cp		'B' Average Cp		Difference	
	—		=		|Difference| ≤ 0.01

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

All specifications are from EPA 600/4-77-027a Section 4.

Probe Cp= 0.84 Calibrated by: _____ Date: 2-25-02

Wheelabrator North Broward, Inc.
Clean Air Project No: 9156-3
FF Outlet

USEPA Method 29
QA/QC Results

Run No.		1	2	3
Date (2002)		December 3	December 3	December 3
Start Time (approx.)		07:47	09:59	12:10
Stop Time (approx.)		09:58	12:09	16:21
Total Duration of Test Run (min.)		131	130	251
Net Sampling Time (min.)		125	125	125
Sampling System Calibration Summary				
	Nozzle ID No:	280-66-1	280-66-2	280-66-1
D_n	Nozzle Diameter (in):	0.280	0.280	0.280
	Probe ID No:	67-8-13	M-8-2	67-8-13
C_p	Pitot Coefficient:	0.84	0.84	0.84
	Meter Box ID. No:	66-10	66-13	66-10
Y_d	Meter Box Yd - Field Sheet	1.0024	0.9956	1.0024
	Meter Box Yd - Database	1.0024	0.9956	1.0024
	Meter Box ΔH@ - Field Sheet	1.6830	1.7701	1.6830
	Meter Box ΔH@ - Database	1.6830	1.7701	1.6830
QA/QC				
	Final Leak Check			
	(a) 4% of Sampling Rate (cfm)	0.0274	0.0262	0.0284
	(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
	Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
	Actual Final Leak Rate (cfm)	0.0010	0.0010	0.0010
	Sample Volume			
	Minimum Volume Required (dscf)	60.00	60.00	60.00
V_{mstd}	Actual Sample Volume (dscf)	85.16	79.36	86.44
	Mean Isokinetic Sampling Rate Variation			
	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	100.38	96.69	99.55
	Point-by-Point Isokinetic Variation			
	Number of points <90%	0	0	0
	Number of points >110%	0	0	0
	Number of points <80%	0	0	0
	Number of points >120%	0	0	0

121602 151147

Prepared by Clean Air Engineering Proprietary Software
SS ISOKINETIC Version2_05-2002

QA/QC _____
Date _____

FIELD DATA

D

TEST LOCATION: FF Outlet

UNIT: 3 **RUN:** 1

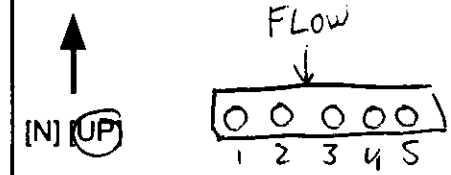
Hg TESTING FIELD DATA SHEET

METHOD: 29 **PAGE** 1 **OF** 2

Client Wheelabrator	Project No. 9156
Plant N Brevard	Date 12/3/02
Meter Operator M Ambler	
Probe Operator M Ambler	

Meter Box No. 66-10	Sample Box No. 67-26
Meter Yd 1.0024 ~~1.0056~~ SB	Meter ΔH@ SB 1.7316 1.683
K Factor 2.85	Pitot Cp 0.84
Leak Rate Before .006	(cfm) [Lpm] @ 16 (in.Hg)
Leak Rate After .001	(cfm) [Lpm] @ 5 (in.Hg)
Pitot Leak Check Before: ☒	After: Good ☒ Bad ☐

Cross-Section of Test Location



Duct Dimensions (in.) 96x96			
Static Press. (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way (In) [Out]
-12.7	10		

Amb. Temp. (°F) 68	Bar. Press. 30.10 (In. Hg) [mbar]
Probe I.D. No. 67-8-13	
Liner Material Glass	

Filter No. n/a		
Thimble No. n/a		
Nozzle Diameter .280	Nozzle I.D.	280-66-1

H_2O [ml] [gm]	Silica Gel (gm)
Total V_{lc}	

Start Time: 7:47	Stop Time: 9:58

Traverse Point Number	Min/pt 5.0 Elapsed Time	Velocity Head ΔP's (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ft³) [L] 260.266	Stack Temp. T_s (°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 T_t (°F)	Notes
						250	250						
1-1	5	.40	1.15	263.38	305	239	243	58	65	63	3.0	n/a	
2	10	.40	1.15	266.41	307	249	246	53	68	64	3.0		
3	15	.43	1.25	269.63	306	250	246	52	72	66	3.0		
4	20	.43	1.25	272.79	306	250	247	51	75	67	3.0		
5	25	.39	1.10	275.80	304	249	248	52	76	68	3.0		Pt=275.87 - .07
2-1	30	.46	1.30	279.14	303	249	249	54	77	69	3.0		
2	35	.56	1.60	282.73	307	252	250	52	79	70	3.5		
3	40	.43	1.25	285.99	308	251	249	48	81	71	3.0		
4	45	.48	1.35	289.34	308	250	250	47	82	72	3.5		
5	50	.48	1.35	292.68	309	250	250	47	83	74	3.5		Pt=292.77 - .09
3-1	55	.44	1.25	296.00	306	249	249	49	82	74	3.5		
2	60	.57	1.60	299.63	307	250	250	48	83	74	4.0		
	Total	8.0872	15.6000	85.7340	3676.0000				923	832			
	Average	.6739	1.4220		306.2800					77.7000			

DS 001 General
CNVS/TRG.R3-4/6/94

* Sum of square roots. (.7045)

Circle correct bracketed units on data sheet.

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067
800-627-0033 Fax (847) 991-3385

TEST LOCATION: FF Outlet

UNIT: 3 **RUN:** 1

Hg TESTING FIELD DATA SHEET

METHOD: 29 **PAGE** 2 **OF** 2

Client Wheelabrator	Project No. 9156
Plant N Brevard	Date 12/3/02
Meter Operator M Ambler	
Probe Operator M Ambler	

Meter Box No.	Sample Box No.	
Meter Yd	Meter ΔH@	
K Factor	Pitot Cp	
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 Press. (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.	

H_2O [ml] [gm]	Silica Gel (gm)
Total V_{lc}	

Start Time:	Stop Time:

Traverse Point Number	Min/pt 5.0 Elapsed Time	Velocity Head ΔP's (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ft³) [L] 260.266	Stack Temp. T_s (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp T_t (°F)	Notes
3-3	65	.53	1.50	299303.17	309	251	247	48	84	75	3.5	n/a	
4	70	.47	1.35	306.52	308	250	247	48	84	76	3.5		
5	75	.44	1.25	309.77	308	250	245	45	85	76	3.5		Pt: 309.95 = 118
4-1	80	.66	1.90	313.89	303	249	246	45	84	77	4.0		
2	85	.58	1.65	317.61	309	250	246	45	86	77	4.0		
3	90	.54	1.55	321.24	308	251	248	47	86	78	4.0		
4	95	.60	1.70	325.02	306	250	247	48	86	78	4.0		
5	100	.60	1.70	328.77	311	250	248	50	87	79	4.0		Pt: 328.08 = .11
5-1	105	.41	1.15	332.00	307	248	249	54	85	79	3.5		
2	110	.48	1.35	335.37	303	251	249	54	86	79	4.0		
3	115	.52	1.50	339.01	296	250	250	54	87	80	4.0		
4	120	.55	1.55	342.55	307	250	248	54	88	80	4.0		
5	125 Total	.63	1.80	346.450	306	249	248	55	88	80	4.5		
	Average	9.5245	19.9500		3981.0000				1116	1014			

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067
800-627-9022 Fax (847) 991-3285

* Sum of square roots

Circle correct bracketed units on data sheet.

-45

TEST LOCATION: FF Outlet

UNIT: 3 **RUN:** 2

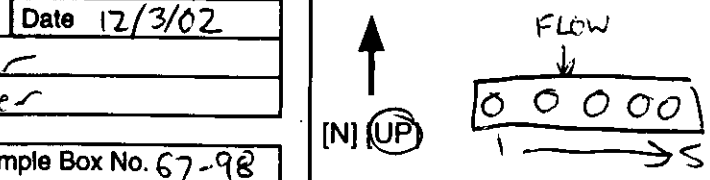
Hg TESTING FIELD DATA SHEET

METHOD: 29 **PAGE** 1 **OF** 2

Client Wheelabrator	Project No. 9156
Plant N Broward	Date 12/3/02
Meter Operator M Ambler	
Probe Operator M Ambler	

Meter Box No. 66-13		Sample Box No. 67-98	
Meter Yd .9956		Meter ΔH@ 1.7701	
K Factor 2.92		Pitot Cp 0.84	
Leak Rate Before .002	[cfm] [Lpm] @ 15	(in.Hg)	
Leak Rate After 00)	[cfm] [Lpm] @ 6.0	(in.Hg)	
Pitot Leak Check Before: ☒	After: Good ☑	Bad ☐	

Cross-Section of Test Location



Duct Dimensions (in.) 96x96

Static Press. (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
-13.4	10		(In)

Amb. Temp. (°F) 74	Bar. Press. 30.10	[in. Hg] [mbar]
Probe I.D. No. M-8-2		
Liner Material Glass		

Filter No. n/a		
Thimble No. n/a		
Nozzle Diameter .280	Nozzle I.D. 280-66-2	

H_2O [ml] [gm]	Silica Gel (gm)
Total V_{lc}	

Start Time: 9:59	Stop Time: 12:09

Traverse Point Number	Min/pt 5.0 Elapsed Time	Velocity Head ΔP's (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ft³) [L] 558.215	Stack Temp. T_s (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp T_t (°F)	Notes
1-1	5	.40	1.15	561.34	310	248	246	65	76	82	3.5	n/a	
2	10	.47	1.35	564.48	308	253	259	46	80	82	3.5		
3	15	.45	1.30	568.61	309	252	252	47	86	81	3.5		
4	20	.45	1.30	570.77	309	251	251	50	89	81	3.5		
5	25	.39	1.15	573.741	308	251	246	50	90	81	3.0		Pnt = 573.84 = .10
2-1	30	.52	1.50	577.19	306	245	245	55	90	82	3.5		
2	35	.43	1.25	580.33	308	248	249	56	92	82	3.5		
3	40	.49	1.45	583.62	310	251	246	58	93	82	3.5		
4	45	.45	1.30	586.82	310	251	248	58	94	82	3.5		
5	50	.42	1.25	589.95	307	251	247	48	94	82	3.5		Pnt = 590.01 = .06
3-1	55	.40	1.15	593.01	307	248	242	48	92	82	3.5		
2	60	.40	1.15	596.00	309	249	247	47	94	83	3.0		
	Total	7.9448*	15.3000	81.9500	3701.0000				1070	982			
	Average	.6897	1.3920		307.1200					87.7400			

DS 001 General
CNVS/TRG.R3-4/6/94

* Sum of square roots.

Circle correct bracketed units on data sheet.

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067
800-627-0033 Fax (847) 991-3385

TEST LOCATION: FF Outlet

UNIT: 3 **RUN:** 2

Hg TESTING FIELD DATA SHEET

METHOD: 29 **PAGE** 2 **OF** 2

Client Wheelabrator	Project No. 9156
Plant N Brunswick	Date 12/3/02
Meter Operator M Ambler	
Probe Operator M Ambler	

Meter Box No.	Sample Box No.
Meter Yd	Meter ΔH@
K Factor	Pitot Cp
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 Press. (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.	

H_2O [ml] [gm]	Silica Gel (gm)
Total V_{lc}	

Start Time:	Stop Time:

Traverse Point Number	Min/pt 5.0 Elapsed Time	Velocity Head ΔP's (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ft³) [L] 558.215	Stack Temp. T_s (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp T_t (°F)	Notes
3-3	65	.54	1.60	599.49	308	251	246	47	95	84	4.0	n/a	
4	70	.47	1.35	602.73	307	251	249	48	96	83	3.5		
5	75	.42	1.25	605.91	308	250	251	50	96	83	3.5		Pit: 605.95 ≤.04
4-1	80	.71	2.05	609.88	307	247	243	54	95	83	4.5		
2	85	.54	1.60	613.42	311	250	250	52	97	82	4.0		
3	90	.57	1.65	617.00	308	251	252	54	97	82	4.5		
4	95	.50	1.45	620.43	307	251	249	56	97	82	4.0		
5	100	.46	1.35	623.70	309	250	252	54	97	82	4.0		Pit: 623.79 ≤.09
5-1	105	.43	1.25	626.93	296	248	243	57	95	83	4.0		
2	110	.48	1.40	630.22	300	250	251	54	97	84	4.0		
3	115	.48	1.40	633.53	301	250	244	55	97	84	4.0		
4	120	.57	1.65	636.99	306	251	246	56	98	84	4.5		
5	125 Total	.51	1.50	640.455	309	250	246	57	98	84	4.0		
	Average	9.2968	19.5000		3077.0000				1255	1080			

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067
800-627-6033 Fax (847) 991-3385

* Sum of square roots.

Circle correct bracketed units on data sheet.

TEST LOCATION: FF Outlet

UNIT: 3 **RUN:** 3

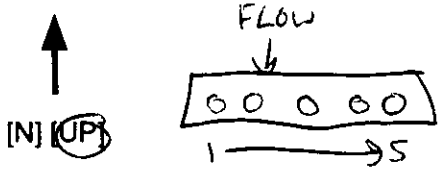
Hg TESTING FIELD DATA SHEET

METHOD: 29 **PAGE** 1 **OF** 2

Client Wheelabrator	Project No. 9156
Plant N Brevard	Date 12/3/02
Meter Operator M Ambler	
Probe Operator M Ambler	

Meter Box No. 66-10	Sample Box No. 67-26
Meter Yd .0024 ~~.9956~~	Meter ΔH@ .8231 1.6830
K Factor 2.85	Pitot Cp 0.84
Leak Rate Before .002	(cfm) [Lpm] @ 15.5 (in.Hg)
Leak Rate After .001	(cfm) [Lpm] @ 5.0 (in.Hg)
Pitot Leak Check Before: ☒	After: Good ☒ Bad ☐

Cross-Section of Test Location



Duct Dimensions (in.) 96×96

Static Press. (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
-13.3	10		

Amb. Temp. (°F) 74	Bar. Press. 30.10 [in. Hg] [mbar]
Probe I.D. No. 67-8-13	
Liner Material Glass	

Filter No. N/a		
Thimble No. N/a		
Nozzle Diameter .280	Nozzle I.D.	280-66-1

H_2O [ml] [gm]	Silica Gel (gm)
Total V_{lc}	

Start Time: 12:10	Stop Time: 16:21

Traverse Point Number	Min/pt 5.0 Elapsed Time	Velocity Head ΔP's (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ft³) [L] 347.052	Stack Temp. T_s (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp T_t (°F)	Notes
1-1	5	.46	1.30	350.42	306	245	246	66	79	77	3.0	N/a	
2	10	.50	1.45	353.77	306	252	248	54	84	79	3.5		
3	15	.57	1.60	357.53	306	251	248	54	88	80	4.0		
4	20	.51	1.45	361.10	306	250	249	56	91	81	3.5		
5	25	.44	1.25	364.32	306	250	249	61	93	83	3.5		Pit: 364.46 = .14
2-1	30	.50	~~.86~~ 1.45	367.63	303	251	249	66	93	84	3.5		Stop 12:40 Unit problems Start 13:22
2	35	.53	1.50	371.27	304	241	249	56	87	85	3.5		
3	40	.54	1.55	374.90	305	251	250	52	92	86	3.5		
4	45	.47	1.35	378.34	306	251	251	49	94	87	3.5		
5	50	.47	1.35	381.71	305	250	251	50	94	87	3.5		Pit: 381.80 = .09
3-1	55	.46	1.30	385.13	303	248	250	55	93	87	3.5		
2	60	.60	1.70	388.99	305	250	249	56	94	87	4.0		
	Total	8.5117	17.2500	88.8080	3661.0000				1082	1003			
	Average	.7204	1.4912		304.6000					88.8400			

* Sum of square roots.

Circle correct bracketed units on data sheet.

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067
800-627-0033 Fax (847) 991-3385

TEST LOCATION: FF Outlet

Hg TESTING FIELD DATA SHEET

METHOD: 29 **PAGE** 2 **OF** 2

UNIT: 3 **RUN:** 3

Client Wheelabrator	Project No. 9156
Plant N Broward	Date 12/3/02
Meter Operator MAmbler	
Probe Operator MAmbler	

Meter Box No.	Sample Box No.
Meter Yd	Meter ΔH@
K Factor	Pitot Cp
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 Press. (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.	

H_2O [ml] [gm]	Silica Gel (gm)
Total V_{lc}	

Start Time:	Stop Time:

Traverse Point Number	Min/pt 5.0 Elapsed Time	Velocity Head ΔP's (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ff) [L] 347.052	Stack Temp. T_s (°F)	Probe T_p (°F) Set Points 250	Filter T_f (°F) Set Points 250	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp T_t (°F)	Notes
3-3	65	.57	1.60	392.72	306	251	250	57	94	87	4.0	n/a	
4	70	.52	1.50	396.33	307	250	250	53	95	88	4.0		
5	75	.50	1.45	399.90	306	249	249	52	96	88	4.0		Pit: 400.03 ≈ 13
4-1	80	.68	1.95	404.13	303	250	250	54	96	88	4.5		
2	85	.68	1.95	408.23	306	250	250	53	97	89	4.5		NV: 408.76 = .53
3	90	.60	1.70	412.62	305	251	250	54	98	89	4.0		Stop 14:23 Start 15:58
4	95	.60	1.70	416.43	305	250	250	53	89	86	4.0		
5	100	.50	1.45	419.94	304	250	251	47	92	86	4.0		Pit: 420.14 = .20
5-1	105	.31	.88	422.87	305	249	250	52	92	86	3.5		
2	110	.50	1.45	426.40	299	251	250	52	92	86	4.0		sampled @ pt. 3 because T-beam in way
3	115	.43	1.25	429.66	298	250	249	53	94	87	4.0		
4	120	.51	1.45	433.15	305	250	250	55	94	87	4.0		
5	125 Total	.60	1.70	436.950	305	250	250	55	94	87			
	Average	9.4971	20.0300		3954.0000				1223	) 1134			

Clean Air Engineering
500 West Wood Street
Palatine, IL 60067
800-627-0033 Fax (847) 991-3385

* Sum of square roots.

Circle correct bracketed units on data sheet.

Impinger Weight Sheet

Client: Wheelabrator Unit Name: 3 FF Outlet

Plant: North Broward Job #: 9156 Method: 29

Sample Box #: 67-26 Date: 12/3/2002

Run #: 1

	Contents	Gross Weight	Tare Weight	Net Weight Gain	Total Weight
Impinger 1	empty	732.7	441.2	291.5	
Impinger 2	100 mL 5%/10%	664.6	534.8	129.8	
Impinger 3	100 mL 5%/10%	547.7	528.0	19.7	
Impinger 4	empty	462.4	457.8	4.6	
Impinger 5	100 mL 4%/10%	545.9	543.9	2.0	
Impinger 6	100 mL 4%/10%	558.9	557.0	1.9	449.5
Impinger 7	Silica gel	782.8	764.4	18.4	467.9

Sample Box #: 67-98A Date: 12/31/2002

Run #: 2

	Contents	Gross Weight	Tare Weight	Net Weight Gain	Total Weight
Impinger 1	empty	757.5	439.6	317.9	
Impinger 2	100 mL 5%/10%	635.8	537.2	98.6	
Impinger 3	100 mL 5%/10%	549.4	530.9	18.5	
Impinger 4	empty	442.8	439.3	3.5	
Impinger 5	100 mL 4%/10%	552.7	548.3	4.4	
Impinger 6	100 mL 4%/10%	539.2	538.2	1.0	443.9
Impinger 7	Silica gel	774.3	758.4	15.9	459.8

Sample Box #: 67-26 Date: 12/3/2002

Run #: 3

	Contents	Gross Weight	Tare Weight	Net Weight Gain	Total Weight
Impinger 1	empty	450.3	443.0	7.3	
Impinger 2	100 mL 5%/10%	808.6	537.8	270.8	
Impinger 3	100 mL 5%/10%	701.9	532.1	169.8	
Impinger 4	empty	464.3	459.2	5.1	
Impinger 5	100 mL 4%/10%	550.4	548.5	1.9	
Impinger 6	100 mL 4%/10%	559.9	559.1	0.8	455.7
Impinger 7	Silica gel	797.6	782.5	15.1	470.8

ORSAT READINGS

TEST LOCATION: FF outlet **PAGE** 1 **OF** _____

Client: Wheelabrator	Project Number: 9156	$Fo = \frac{20.9 - \%O_2}{\%CO_2}$	
Plant: North Broward	Unit: 3		
Orsat ID: #11	Fuel Type:	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	29	1	8.0	19.2	11.2	1.1975	KO	12/3	14:00
		2	8.2	19.4	11.2				
		3	8.2	19.4	11.2				
		Avg	8.1	19.3	11.2				
2	29	1	8.8	19.8	11.0	1.1264	KO	12/3	14:30
		2	8.6	19.8	11.2				
		3	8.6	19.6	11.2				
		Avg	8.7	19.7	11.1				
3	29	1	9.0	18.8	9.8	1.2584	MA	12/3	16:50
		2	8.8	18.6	9.8				
		3	8.8	18.4	9.6				
		Avg	8.9	18.6	9.7				
4	29	1	9.0	19.0	10.0	1.2135	KO	12/4	9:40
		2	8.8	19.0	10.2				
		3	9.0	19.0	10.0				
		Avg	8.9	19.0	10.1				
5	29	1	9.0	19.2	10.2	1.1889	KO	12/4	11:55
		2	9.0	19.2	10.2				
		3	9.0	19.2	10.2				
		Avg	9.0	19.2	10.2				
6	29	1	8.8	19.6	10.8				
		2	8.8	19.4	10.6				
		3	8.8	19.6	10.8				
		Avg	8.8	19.5	10.7				

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 Fo to verify results.

Acceptable ranges for Fo:

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

QA/QC_____
Date_____

CleanAir ENGINEERING

FIELD DATA PRINTOUTS

E

Field Data Printout

Test Method: USEPA Method 29
Analyte: Mercury

Location: FF Outlet
Test Run: 1
Client: Wheelabrator North Broward, Inc.
Project No: 9156-3
Source Area (ft^2): 64.00000

Test Date: 12/03/02
Start Time: 07:47
Stop Time: 09:58
Leak Rate Before: 0.006 cfm @ 16 "Hg
Leak Rate After: 0.001 cfm @ 5 "Hg

Bar. Press. (in. Hg): 30.10
Static P: -12.7
O_2 (dry volume %): 11.20
CO_2 (dry volume %): 8.13
N_2+CO (dry volume %): 80.67

H_2O (condensate, ml or gm): 449.5
H_2O (silica, g): 18.4
Actual Moisture (%): 20.55

Nozzle ID No: 280-66-1
Nozzle Diameter (D_n): 0.280
Probe ID No: 67-8-13
Pitot C_p: 0.84
Pitot Leak Check: ☑ Pass ☐ Fail

Meter Box ID. No: 66-10
Meter ΔH@: 1.68300
Meter Y_d: 1.00240

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			260.27						
1-01	5.0	0.40	1.15	263.38	305	65	63	0.63	3.11	104.0
1-02	10.0	0.40	1.15	266.41	307	68	64	0.63	3.03	101.0
1-03	15.0	0.43	1.25	269.63	306	72	66	0.66	3.22	102.9
1-04	20.0	0.43	1.25	272.79	306	75	67	0.66	3.16	100.6
1-05	25.0	0.39	1.10	275.80	304	76	68	0.62	3.01	100.2
Leak Check	25.0			275.87						
2-01	30.0	0.46	1.30	279.14	303	77	69	0.68	3.27	100.1
2-02	35.0	0.56	1.60	282.73	307	79	70	0.75	3.59	99.6
2-03	40.0	0.43	1.25	285.99	308	81	71	0.66	3.26	102.9
2-04	45.0	0.48	1.35	289.34	308	82	72	0.69	3.35	99.9
2-05	50.0	0.48	1.35	292.68	309	83	74	0.69	3.34	99.4
Leak Check	50.0			292.77						
3-01	55.0	0.44	1.25	296.00	306	82	74	0.66	3.23	100.3
3-02	60.0	0.57	1.60	299.63	307	83	74	0.75	3.63	99.1
3-03	65.0	0.53	1.50	303.17	309	84	75	0.73	3.54	100.1
3-04	70.0	0.47	1.35	306.52	308	84	76	0.69	3.35	100.4
3-05	75.0	0.44	1.25	309.77	308	85	76	0.66	3.25	100.6
Leak Check	75.0			309.95						
4-01	80.0	0.66	1.90	313.89	303	84	77	0.81	3.94	99.4
4-02	85.0	0.58	1.65	317.61	309	86	77	0.76	3.72	100.3
4-03	90.0	0.54	1.55	321.24	308	86	78	0.73	3.63	101.2
4-04	95.0	0.60	1.70	325.02	306	86	78	0.77	3.78	99.9
4-05	100.0	0.60	1.70	328.77	311	87	79	0.77	3.75	99.2
Leak Check	100.0			328.88						
5-01	105.0	0.41	1.15	332.00	307	85	79	0.64	3.12	99.7
5-02	110.0	0.48	1.35	335.37	303	86	79	0.69	3.37	99.2
5-03	115.0	0.52	1.50	339.01	296	87	80	0.72	3.64	102.3
5-04	120.0	0.55	1.55	342.55	307	88	80	0.74	3.54	97.4
5-05	125.0	0.63	1.80	346.45	306	88	80	0.79	3.90	100.2
Final	125.0		1.42200	85.73400	306.28000	77.70000		0.70447	85.73400	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.7045	1.4220	85.7340	306.2800	77.7000				
		☐ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

121602 150715

QA/QC _____
Date _____

Field Data Printout

Test Method: **USEPA Method 29**
Analyte: **Mercury**

Location: FF Outlet
Test Run: 2
Client: Wheelabrator North Broward, Inc.
Project No: 9156-3
Source Area (ft^2): 64.00000

Test Date: 12/03/02
Start Time: 09:59
Stop Time: 12:09
Leak Rate Before: 0.002 cfm @ 15 "Hg
Leak Rate After: 0.001 cfm @ 6 "Hg

Bar. Press. (in. Hg): 30.10
Static P: -13.4
O_2 (dry volume %): 11.07
CO_2 (dry volume %): 8.67
N_2+CO (dry volume %): 80.27

H_2O (condensate, ml or gm): 443.9
H_2O (silica, g): 15.9
Actual Moisture (%): 21.43

Nozzle ID No: 280-66-2
Nozzle Diameter (D_n): 0.280
Probe ID No: M-8-2
Pitot C_p: 0.84
Pitot Leak Check: ☑ Pass ☐ Fail

Meter Box ID. No: 66-13
Meter ΔH@: 1.77010
Meter Y_d: 0.99560

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			558.22						
1-01	5.0	0.40	1.15	561.34	310	76	82	0.63	3.13	102.3
1-02	10.0	0.47	1.35	564.48	308	80	82	0.69	3.14	94.4
1-03	15.0	0.45	1.30	567.61	309	86	81	0.67	3.13	95.8
1-04	20.0	0.45	1.30	570.77	309	89	81	0.67	3.16	96.4
1-05	25.0	0.39	1.15	573.74	308	90	81	0.62	2.97	97.1
Leak Check	25.0			573.84						
2-01	30.0	0.52	1.50	577.19	306	90	82	0.72	3.35	94.8
2-02	35.0	0.43	1.25	580.33	308	92	82	0.66	3.14	97.6
2-03	40.0	0.49	1.45	583.62	310	93	82	0.70	3.29	95.8
2-04	45.0	0.45	1.30	586.82	310	94	82	0.67	3.20	97.2
2-05	50.0	0.42	1.25	589.95	307	94	82	0.65	3.13	98.2
Leak Check	50.0			590.01						
3-01	55.0	0.40	1.15	593.01	307	92	82	0.63	3.00	96.6
3-02	60.0	0.40	1.15	596.00	309	94	83	0.63	2.99	96.1
3-03	65.0	0.54	1.60	599.49	308	95	84	0.73	3.49	96.4
3-04	70.0	0.47	1.35	602.73	307	96	83	0.69	3.24	95.8
3-05	75.0	0.42	1.25	605.91	308	96	83	0.65	3.18	99.5
Leak Check	75.0			605.95						
4-01	80.0	0.71	2.05	609.88	307	95	83	0.84	3.93	94.8
4-02	85.0	0.54	1.60	613.42	311	97	82	0.73	3.54	98.0
4-03	90.0	0.57	1.65	617.00	308	97	82	0.75	3.58	96.3
4-04	95.0	0.50	1.45	620.43	307	97	82	0.71	3.43	98.4
4-05	100.0	0.46	1.35	623.70	309	97	82	0.68	3.27	97.9
Leak Check	100.0			623.79						
5-01	105.0	0.43	1.25	626.93	296	95	83	0.66	3.14	96.4
5-02	110.0	0.48	1.40	630.22	300	97	84	0.69	3.29	95.7
5-03	115.0	0.48	1.40	633.53	301	97	84	0.69	3.31	96.3
5-04	120.0	0.57	1.65	636.99	306	98	84	0.75	3.46	92.7
5-05	125.0	0.51	1.50	640.46	309	98	84	0.71	3.47	98.3
Final	125.0		1.39200	81.95000	307.12000	87.74000		0.68966	81.95000	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.6897	1.3920	81.9500	307.1200	87.7400				
		☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

121602 135720

QA/QC _____
Date _____

Field Data Printout

Test Method: **USEPA Method 29**
Analyte: **Mercury**

Location: FF Outlet
Test Run: 3
Client: Wheelabrator North Broward, Inc.
Project No: 9156-3
Source Area (ft^2): 64.00000

Test Date: 12/03/02
Start Time: 12:10
Stop Time: 16:21
Leak Rate Before: 0.002 cfm @ 16 "Hg
Leak Rate After: 0.001 cfm @ 5 "Hg

Bar. Press. (in. Hg): 30.10
Static P: -13.3
O_2 (dry volume %): 9.73
CO_2 (dry volume %): 8.87
N_2+CO (dry volume %): 81.40

H_2O (condensate, ml or gm): 455.7
H_2O (silica, g): 15.1
Actual Moisture (%): 20.41

Nozzle ID No: 280-66-1
Nozzle Diameter (D_n): 0.280
Probe ID No: 67-8-13
Pitot C_p: 0.84
Pitot Leak Check: ☑ Pass ☐ Fail

Meter Box ID. No: 66-10
Meter ΔH@: 1.68300
Meter Y_d: 1.00240

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			347.05						
1-01	5.0	0.46	1.30	350.42	306	79	77	0.68	3.37	102.3
1-02	10.0	0.50	1.45	353.77	306	84	79	0.71	3.35	97.0
1-03	15.0	0.57	1.60	357.53	306	88	80	0.75	3.76	101.5
1-04	20.0	0.51	1.45	361.10	306	91	81	0.71	3.57	101.5
1-05	25.0	0.44	1.25	364.32	306	93	83	0.66	3.22	98.2
Leak Check	25.0			364.46						
2-01	30.0	0.50	1.45	367.63	303	93	84	0.71	3.17	90.4
2-02	35.0	0.53	1.50	371.27	304	87	85	0.73	3.64	101.4
2-03	40.0	0.54	1.55	374.90	305	92	86	0.73	3.63	99.7
2-04	45.0	0.47	1.35	378.34	306	94	87	0.69	3.44	101.0
2-05	50.0	0.47	1.35	381.71	305	94	87	0.69	3.37	98.9
Leak Check	50.0			381.80						
3-01	55.0	0.46	1.30	385.13	303	93	87	0.68	3.33	98.8
3-02	60.0	0.60	1.70	388.99	305	94	87	0.77	3.86	100.4
3-03	65.0	0.57	1.60	392.72	306	94	87	0.75	3.73	99.5
3-04	70.0	0.52	1.50	396.33	307	95	88	0.72	3.61	100.7
3-05	75.0	0.50	1.45	399.90	306	96	88	0.71	3.57	101.4
Leak Check	75.0			400.03						
4-01	80.0	0.68	1.95	404.13	303	96	88	0.82	4.10	99.8
4-02	85.0	0.68	1.95	408.23	306	97	89	0.82	4.10	99.8
Leak Check	85.0			408.76						
4-03	90.0	0.60	1.70	412.62	305	98	89	0.77	3.86	99.8
4-04	95.0	0.60	1.70	416.43	305	89	86	0.77	3.81	99.6
4-05	100.0	0.50	1.45	419.94	304	92	86	0.71	3.51	100.1
Leak Check	100.0			420.14						
5-01	105.0	0.31	0.88	422.87	305	92	86	0.56	2.73	98.8
5-02	110.0	0.50	1.45	426.40	299	92	86	0.71	3.53	100.4
5-03	115.0	0.43	1.25	429.66	298	94	87	0.66	3.26	99.6
5-04	120.0	0.51	1.45	433.15	305	94	87	0.71	3.49	98.4
5-05	125.0	0.60	1.70	436.95	305	94	87	0.77	3.80	98.8
Final	125.0		1.49120	88.80800	304.60000	88.84000		0.72035	88.80800	
25 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.7204	1.4912	88.8080	304.6000	88.8400				
		☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK	☑ Avg. OK				

121602 151113

QA/QC _____
Date _____

USEPA Method 3 Laboratory Data

Test Method: USEPA Method 29
Analyte: Mercury

Location: FF Outlet
Client: Wheelabrator North Broward, Inc.
Project No: 9156-3
Method: EPA Method 3
Fuel Type: Municipal Waste
F_o for Fuel: 1.03 to 1.3

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	8.0	19.2	11.2	80.8	29.73		
	2	8.2	19.4	11.2	80.6	29.76		
	3	8.2	19.4	11.2	80.6	29.76		
	Avg.	8.13333		11.20000	80.66667	29.75	1.19262	*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	8.8	19.8	11.0	80.2	29.85		
	2	8.6	19.8	11.2	80.2	29.82		
	3	8.6	19.6	11.0	80.4	29.82		
	Avg.	8.66667		11.06667	80.26667	29.83	1.13462	*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	9.0	18.8	9.8	81.2	29.83		
	2	8.8	18.6	9.8	81.4	29.80		
	3	8.8	18.4	9.6	81.6	29.79		
	Avg.	8.86667		9.73333	81.40000	29.81	1.25940	*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
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								☐ Fo value within expected range.

121802 101815

QA/QC _____
Date _____

USEPA Method 4 Laboratory Data

Test Method: USEPA Method 29
Analyte: Mercury

Location: FF Outlet
Client: Wheelabrator North Broward, Inc.
Project No: 9156-3

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	732.7	441.2	291.5
Impinger 2	5%HNO3/10%H2O2	664.6	534.8	129.8
Impinger 3	5%HNO3/10%H2O2	547.7	528.0	19.7
Impinger 4	Empty	462.4	457.8	4.6
Impinger 5	4%KMnO4/10%H2SO4	545.9	543.9	2.0
Impinger 6	4%KMnO4/10%H2SO4	558.9	557.0	1.9
Impinger 7	Silica Gel	782.8	764.4	18.4
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
449.5	Liquid (gm)		
0.0	less rinse (gm)		
449.5	Net Liquid (gm)	449.5	☑ QA/QC OK
+ 18.4	Silica Gel (gm)	18.4	☑ QA/QC OK
467.9	Total Vlc (gm)	467.9	☑ QA/QC OK

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	757.5	439.6	317.9
Impinger 2	5%HNO3/10%H2O2	635.8	537.2	98.6
Impinger 3	5%HNO3/10%H2O2	549.4	530.9	18.5
Impinger 4	Empty	442.8	439.3	3.5
Impinger 5	4%KMnO4/10%H2SO4	552.7	548.3	4.4
Impinger 6	4%KMnO4/10%H2SO4	539.2	538.2	1.0
Impinger 7	Silica Gel	774.3	758.4	15.9
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
443.9	Liquid (gm)		
0.0	less rinse (gm)		
443.9	Net Liquid (gm)	443.9	☑ QA/QC OK
+ 15.9	Silica Gel (gm)	15.9	☑ QA/QC OK
459.8	Total Vlc (gm)	459.8	☑ QA/QC OK

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	450.3	443.0	7.3
Impinger 2	5%HNO3/10%H2O2	808.6	537.8	270.8
Impinger 3	5%HNO3/10%H2O2	701.9	532.1	169.8
Impinger 4	Empty	464.3	459.2	5.1
Impinger 5	4%KMnO4/10%H2SO4	550.4	548.5	1.9
Impinger 6	4%KMnO4/10%H2SO4	559.9	559.1	0.8
Impinger 7	Silica Gel	797.6	782.5	15.1
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
455.7	Liquid (gm)		
0.0	less rinse (gm)		
455.7	Net Liquid (gm)	455.7	☑ QA/QC OK
+ 15.1	Silica Gel (gm)	15.1	☑ QA/QC OK
470.8	Total Vlc (gm)	470.8	☑ QA/QC OK

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty			
Impinger 2	5%HNO3/10%H2O2			
Impinger 3	5%HNO3/10%H2O2			
Impinger 4	Empty			
Impinger 5	4%KMnO4/10%H2SO4			
Impinger 6	4%KMnO4/10%H2SO4			
Impinger 7	Silica Gel			
Impinger 8				

Rinse: (ml or gm)

		Field Data Check	
	Liquid (gm)		
	less rinse (gm)		
	Net Liquid (gm)		☐ QA/QC OK
	Silica Gel (gm)		☐ QA/QC OK
	Total Vlc (gm)		☐ QA/QC OK

121802 101815

QA/QC _____
Date _____

LABORATORY DATA

F

Clean Air Engineering, Inc.

500 West Wood Street
Palatine, IL 60067

Project Number: 9156

Mercury

EPA Method 29 Analysis

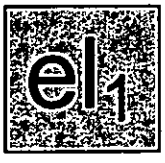
Analytical Report
1181

Element One, Inc.
5022-C Wrightsville Av., Wilmington, NC 28403
910-793-0128 FAX:910-792-6853 e1lab@hotmail.com

I have reviewed the following data for completeness, accuracy, adherence to method protocol, and compliance with quality assurance guidelines.

Quality assurance review by Bruce Hawks

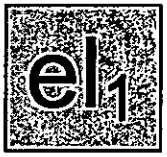
SUMMARY OF RESULTS



Summary of 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
North Run 1	# 1	28.8	4.17	23.5	< 0.2	< 0.5	1.49
	# 2		4.10	22.9	< 0.2	< 0.5	1.50
North Run 2	# 1	26.9	5.62	19.8	< 0.2	< 0.5	1.68
	# 2		5.46	19.6	< 0.2	< 0.5	1.65
North Run 3	# 1	43.1	5.28	36.7	< 0.2	< 0.5	1.39
	# 2		5.14	36.3	< 0.2	< 0.5	1.36
Field Blank	# 1	0.88	< 0.1	< 0.3	< 0.2	< 0.5	0.87
	# 2		< 0.1	< 0.3	< 0.2	< 0.5	0.89
Reagent Blank	# 1	0.92	< 0.1	< 0.3	< 0.2	< 0.4	0.94
	# 2		< 0.1	< 0.3	< 0.2	< 0.4	0.90

ANALYTICAL NARRATIVE



Element One Analytical Narrative

Client	Clean Air Engineering	Element One #:	1181
Client ID:	9156	Analyst:	IJJ
Date Received	12/9/02	Method:	M29
Analytes	Hg	Dates Analyzed	12/11-12/02

Summary of Analysis

The 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 0.001 µg/ml.

Analysis QA/QC

Duplicate analyses relative percent difference (RPD) and spike sample recovery data are summarized on the following pages. 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. Nothing unusual was noticed with any of the samples or analyses.

Mercury Duplicate Analysis RPD

Run Number	Front half	H_2O_2/HNO_3	Empty Imp	$KMnO_4$	HCl
North Run 1	1.6%	2.4%	NA	NA	0.4%
North Run 2	2.8%	1.1%	NA	NA	1.9%
North Run 3	2.7%	0.9%	NA	NA	2.8%
Field Blank	NA	NA	NA	NA	2.5%
Reagent Blank	NA	NA	NA	NA	4.7%

Mercury Spike Recoveries

Run Number		Front half	H_2O_2/HNO_3	Empty Imp	KMnO4	HCl
North Run 3	# 1	123%	103%	98%	97%	105%
	# 2	117%	93%	99%	95%	103%

SAMPLE CUSTODY

CHAIN OF CUSTODY FORM

CLIENT: Wheelabrator
PLANT: North Broward
PROJECT MANAGER: Scott Brown
PROJECT NO.: 1156
DEPT.: 66

CLEANAIR LAB NO.	RUN NO.	TEST LOCATION	DATE	SAMPLE MATRIX	NO. OF CONTAINERS	ORIGINAL VOLUME	ANALYSIS REQUESTED: Hg				ADDITIONAL INFORMATION
	1	Unit 3 FF Outlet	12/3	Filter	1		X				
				Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
				Imp. 5,6 HCl Rinse	1		X				
	2	Unit 3 FF Outlet	12/3	Filter	1		X				
				Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
				Imp. 5,6 HCl Rinse	1		X				

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Relinquished by: (Signature)	Date / Time
Ken O'Halloren	12/6/2002 18.00				
Courier:	Date / Time	Relinquished by: (Signature)	Date / Time	Received for Analysis by: Ken Smith	Date / Time 12-9-02 10:30

Special Handling Instructions

Forwarding Lab:

PO Number:

This form was completed by: Kevin O'Halloren

Signature: Ken O'Halloren Date: 12/6/2002

CleanAir ENGINEERING

LDS001A_1-COC Palatine_M29, Jul 2002

500 West Wood Street
Palatine, IL 60067

(800) 627-0033 ph
(847) 991-3385 fax
www.cleanair.com

CHAIN OF CUSTODY FORM

CLIENT: wheelabrator
PLANT: North Broward
PROJECT MANAGER: Scott Brown
PROJECT NO.: 9156
DEPT.: 66

CLEANAIR LAB NO.	RUN NO.	TEST LOCATION	DATE	SAMPLE MATRIX	NO. OF CONTAINERS	ORIGINAL VOLUME	ANALYSIS REQUESTED: H9				ADDITIONAL INFORMATION
	3	Unit 3 FF Outlet	12/3	Filter	1		X				
	↓	↓	↓	Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
				Imp. 5,6 HCl Rinse	1		X				
	4	Unit 3 FF Outlet	12/4	Filter	1		X				
	↓	↓	↓	Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
				Imp. 5,6 HCl Rinse	1		X				

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Relinquished by: (Signature)	Date / Time
Kevin OHalloren	12/6/2002 18:00				
Courier:	Date / Time	Relinquished by: (Signature)	Date / Time	Received for Analysis by:	Date / Time
				Jon Smith	12-9-02 10:30

Special Handling Instructions

Forwarding Lab:

PO Number:

This form was completed by: Kevin OHalloren

Signature: Kevin OHalloren Date: 12/6/2002

CleanAir ENGINEERING
500 West Wood Street
Palatine, IL 60067
(800) 627-0033 ph
(847) 991-3385 fax
www.cleanair.com

CHAIN OF CUSTODY FORM

CLIENT: Wheelabrator
PLANT: North Broward
PROJECT MANAGER: Scott Brown
PROJECT NO.: 9156
DEPT.: 66

CLEANAIR LAB NO.	RUN NO.	TEST LOCATION	DATE	SAMPLE MATRIX	NO. OF CONTAINERS	ORIGINAL VOLUME	ANALYSIS REQUESTED: Hg				ADDITIONAL INFORMATION
	5	Unit 3 FF Outlet	12/4	Filter	1		X				
	↓	↓	↓	Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
	↓	↓	↓	Imp. 5,6 HCl Rinse	1		X				
	6	Unit 3 FF Outlet	12/4	Filter	1		X				
	↓	↓	↓	Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
	↓	↓	↓	Imp. 5,6 HCl Rinse	1		X				

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Relinquished by: (Signature)	Date / Time
Ken O'Halloren	12/6/2002 18:00				
Courier:	Date / Time	Relinquished by: (Signature)	Date / Time	Received for Analysis by:	Date / Time
				Kelvin Smith	12-9-02 1030

Special Handling Instructions

Forwarding Lab: _____

PO Number: _____

This form was completed by:

Kevin O'Halloren

Signature: Ken O'Halloren Date: 12/6/2002

CleanAir ENGINEERING
500 West Wood Street
Palatine, IL 60067
(800) 627-0033 ph
(847) 991-3385 fax
www.cleanair.com

CHAIN OF CUSTODY FORM

CLIENT Wheelabrator
PLANT North Broward
PROJECT MANAGER Scott Brown
PROJECT NO. 9156
DEPT. 66

CLEANAIR LAB NO.	RUN NO.	TEST LOCATION	DATE	SAMPLE MATRIX	NO. OF CONTAINERS	ORIGINAL VOLUME	ANALYSIS REQUESTED 49				ADDITIONAL INFORMATION
	Field Blank	Unit 3 FF Outlet	12/3	Filter	1		X				
				Front-Half 0.1N HNO3 Rinse	1		X				
				Imp. 1,2,3 + 0.1N HNO3 Rinse	1		X				
				Imp. 4 + 0.1N HNO3 Rinse	1		X				
				Imp. 5,6 KMnO4+H2O Rinse	1		X				
				Imp. 5,6 HCl Rinse	1		X				
				Filter							
				Front-Half 0.1N HNO3 Rinse							
				Imp. 1,2,3 + 0.1N HNO3 Rinse							
				Imp. 4 + 0.1N HNO3 Rinse							
				Imp. 5,6 KMnO4+H2O Rinse							
				Imp. 5,6 HCl Rinse							

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Relinquished by: (Signature)	Date / Time
Ken OHalloren	12/6/2002 18:00				
Courier:	Date / Time	Relinquished by: (Signature)	Date / Time	Received for Analysis by:	Date / Time
				Ken Smith	12-9-02 1030

Special Handling Instructions

Forwarding Lab:

PO Number:

This form was completed by:

Kevin OHalloren

Signature Date

Ken OHalloren 12/6/2002

CleanAir ENGINEERING
500 West Wood Street
Palatine, IL 60067
(800) 627-0033 ph
(847) 991-3385 fax
www.cleanair.com

CHAIN OF CUSTODY FORM

CLIENT Wheelabrator
PLANT North Broward
PROJECT MANAGER Scott Brown
PROJECT NO. 9156
DEPT. 66

CLEANAIR LAB NO.	RUN NO.	TEST LOCATION	DATE	SAMPLE MATRIX	NO. OF CONTAINERS	ORIGINAL VOLUME	ANALYSIS REQUESTED Hg				ADDITIONAL INFORMATION
	NA	Reagent Blank	12/3	Quartz Filters	1	NA	X				9157's RB has 3 filters; please analyze that one
	NA	Reagent Blank		0.1N HNO3	1	~~300~~ 200	X				
	NA	Reagent Blank		DI H_2O	1	~~100~~ 200	X				
	NA	Reagent Blank		5% HNO_3 / 10% H_2O_2	1	200	X				
	NA	Reagent Blank		4% $KMnO_4$ / 10% H_2SO_4	1	~~100~~ 300	X				
	NA	Reagent Blank	↓	8 N HCl / DI H_2O	1	225	X				

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Relinquished by: (Signature)	Date / Time
Ken Ohalloren	12/6/2002 1800				
Courier:	Date / Time	Relinquished by: (Signature)	Date / Time	Received for Analysis by:	Date / Time
				Ron Smith	12-9-02 1030

Special Handling Instructions

Forwarding Lab:

PO Number:

This form was completed by:

Kevin OHalloren

Signature Date

Kevin OHalloren 12/6/2002

CleanAir ENGINEERING
500 West Wood Street
Palatine, IL 60067
(800) 627-0033 ph
(847) 991-3385 fax
www.cleanair.com

ANALYTICAL DATA

elementOne **AIR TESTING SAMPLE SUBMISSION FORM** Lab ID # **e1181**

Client ID/PO#: 9156		Date Received: 12/9/02	Page: 1	of 1
Customer: Clean Air		Results Requested: 12/23/02	Time Rec:	
Address:		Contact: Scott Brown	Rec by: BGH	
		Email:	Via:	
		Phone:	Fax:	
HNO_3 Lot: 1107020	HF Lot: 5101120	HCl Lot: 4102020		
Volume Marked (Y)/ N	Volume Loss Y /(N)/ ?	pH < 2.0 (Y)/ N	Ref. Method: 29	

	Sample Identification		Sample Identification
1	North Broward Run 1	7	North Broward Run 4
2	North Broward Run 2	8	North Broward Run 5
3	North Broward Run 3	9	North Broward Run 6
4	North Broward Run 3 Spike		
5	Field Blank		
6	Reagent Blank		

Elements to Analyze: **Hg – Only analyze sample 1-6; Archive Sample 7-9**

	Front Half		Back Half			HNO_3 (A)		$KMnO_4$ (B)		HCl (C)	
SAMPLE	BV, ml	FV, ml	BV, ml	Used	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml
1	132ml	100ml	~~750ml~~ H2ot 760ml H0mL	— 12-9-02 1535	—	112ml	200ml	565ml	1600ml	230ml	400ml
2	104ml	↓		—	—	110ml	↓	555ml	↓	225ml	↓
3/4	100ml	↓	750ml	—	—	108ml	↓	580ml	↓	225ml	↓
~~5~~ 5	74ml	↓	300ml	—	—	104ml	↓	545ml	↓	230ml	↓
6	100ml	↓	200ml H2O 100mL 1% HNO_3	—	—	200ml	↓	contaminated 3ml DI	Cal w/ late use 400ml	225ml	↓

Comments:

FH·BLK· F.V. = 100ml
FH·BLK·SPK@ 5ug
Spk lot: 021402 A (25 ppm)
12·10·02 1535

Mercury Perkin-Elmer AAWinLab

ID #	Sample_ID	Sam_Date	Sam_Time	Mean_Sig	Mean_ST	Mean_SA	Units	Wt	Dilu
1	Calib Blank	12/11/2002	9:14:18	0.000375			mg/L		
2	STD1=.100ug	12/11/2002	9:15:18	0.011536			mg/L		
3	STD2=.200ug	12/11/2002	9:16:20	0.023397			mg/L		
4	STD3=.300ug	12/11/2002	9:17:27	0.03434			mg/L		
5	STD4=.400ug	12/11/2002	9:18:32	0.042391			mg/L		
6	STD5=.500ug	12/11/2002	9:19:37	0.056106			mg/L		
7	Reagent Blank	12/11/2002	9:21:09	-6.85E-05	-0.00058	-0.00058	mg/L	10	100
8	0.010 = DL	12/11/2002	9:22:12	0.001098	0.009289	0.009289	mg/L		
9	0.200 = QC STD 2	12/11/2002	9:23:20	0.024286	0.212023	0.212023	mg/L		
10	0.200 = QC STD 3	12/11/2002	9:24:24	0.024129	0.210608	0.210608	mg/L		
11	0.020 = DL	12/11/2002	9:25:30	0.002124	0.017994	0.017994	mg/L		
12	0.020 = DL	12/11/2002	9:26:37	0.000119	0.00101	0.00101	mg/L	10	100
13	REAGENT BLANK	12/11/2002	9:27:41	-1.29E-05	-0.00011	-0.00011	mg/L	10	100
14	1181-A-001	12/11/2002	9:29:10	0.000293	0.002477	0.049533	mg/L	10	200
15	1181-A-002	12/11/2002	9:30:40	0.000131	0.001111	0.022215	mg/L	10	200
16	1181-A-003	12/11/2002	9:32:15	0.00065	0.005497	0.109944	mg/L	10	200
17	1181-A-004-SPK	12/11/2002	9:33:47	0.022588	0.196741	3.934813	mg/L	10	200
18	1181-A-005	12/11/2002	9:35:19	-4.9E-06	-4.2E-05	-0.00083	mg/L	10	200
19	1181-A-006	12/11/2002	9:36:53	0.000991	0.00839	0.167807	mg/L	10	200
20	0.010 = DL	12/11/2002	9:44:11	0.001045	0.008837	0.008837	mg/L	10	200
21	0.010 = DL	12/11/2002	9:45:17	0.001109	0.009381	0.009381	mg/L	10	200
22	0.200 = QC STD 2	12/11/2002	9:46:22	0.025198	0.220261	0.220261	mg/L	10	200
23	0.200 = QC STD 2	12/11/2002	9:47:29	0.031517	0.277921	0.277921	mg/L	10	200
24	REAGENT BLANK	12/11/2002	9:48:31	0.000548	0.004636	0.004636	mg/L	10	100
25	Calib Blank	12/11/2002	14:45:14	0.000362			mg/L	10	200
26	STD1=.100ug	12/11/2002	14:46:16	0.010789			mg/L	10	200
27	STD2=.200ug	12/11/2002	14:47:18	0.022022			mg/L	10	200
28	STD3=.300ug	12/11/2002	14:48:24	0.032833			mg/L	10	200
29	STD4=.400ug	12/11/2002	14:49:28	0.041535			mg/L	10	200
30	STD5=.500ug	12/11/2002	14:50:33	0.053683			mg/L	10	200
31	Reagent Blank	12/11/2002	14:52:25	6.44E-06	5.86E-05	5.86E-05	mg/L	10	100
32	0.010 = DL	12/11/2002	14:53:28	0.001043	0.00949	0.00949	mg/L	10	200
33	0.200 = QC STD 2	12/11/2002	14:54:33	0.023012	0.2123	0.2123	mg/L	10	200
34	0.200 = QC STD 3	12/11/2002	14:55:38	0.022989	0.212087	0.212087	mg/L	10	200
35	0.020 = DL	12/11/2002	14:56:44	0.002117	0.01928	0.01928	mg/L	10	200
36	REAGENT BLANK	12/11/2002	14:57:49	0.000147	0.001341	0.001341	mg/L	10	100
37	1181-A-006	12/11/2002	14:59:20	-7.56E-05	-0.00069	-0.01375	mg/L	10	200
38	0.010 = DL	12/11/2002	15:14:14	0.000752	0.00684	0.00684	mg/L	10	400
39	0.010 = DL	12/11/2002	15:15:20	0.001918	0.017461	0.017461	mg/L	10	400
40	0.200 = QC STD 2	12/11/2002	15:16:28	0.022685	0.209241	0.209241	mg/L	10	400
41	REAGENT BLANK	12/11/2002	15:17:30	0.000406	0.003695	0.003695	mg/L	10	100
42	Calib Blank	12/11/2002	16:33:09	0.00017			mg/L		
43	STD1=.100ug	12/11/2002	16:34:11	0.012471			mg/L		
44	STD2=.200ug	12/11/2002	16:35:13	0.025595			mg/L		
45	STD3=.300ug	12/11/2002	16:36:16	0.038457			mg/L		
46	STD4=.400ug	12/11/2002	16:37:20	0.048525			mg/L		

ID #	Sig 1	Std_U 1	Smp_U 1	Sig 2	Std_U 2	Smp_U 2
[redacted]	0.00037485					
[redacted]	0.01153642					
3	0.02339661					
[redacted]	0.03434042					
5	0.04239088					
[redacted]	0.05610624					
[redacted]	-0.0001743	-0.0014726	-0.0014726	0.00003716	0.000314	0.00031401
8	0.00109792	0.00928923	0.00928923			
[redacted]	0.02428567	0.21202308	0.21202308			
10	0.0241288	0.21060814	0.21060814			
[redacted]	0.00212381	0.01799362	0.01799362			
[redacted]	0.00011947	0.00100954	0.00100954			
13	-0.0000129	-0.0001094	-0.0001094			
[redacted]	0.00040512	0.00342453	0.06849065	0.0001809	0.0015288	0.03057523
[redacted]	0.00015605	0.00131871	0.02637439	0.00010684	0.0009028	0.0180562
16	0.00065012	0.00549729	0.10994588	0.0006501	0.0054971	0.10994243
[redacted]	0.02248628	0.19582948	3.91658968	0.02268922	0.1976518	3.95303577
18	0.00001054	0.00008907	0.0017814	-0.0000203	-0.0001723	-0.0034465
[redacted]	0.00032893	0.00278016	0.05560324	0.00165354	0.0140006	0.28001158
[redacted]	0.00104453	0.00883695	0.00883695			
21	0.00110875	0.00938099	0.00938099			
[redacted]	0.02519765	0.22026108	0.22026108			
23	0.03151735	0.27792063	0.27792063			
24	0.0005483	0.00463567	0.00463567			
[redacted]	0.00036221					
26	0.01078862					
[redacted]	0.02202167					
[redacted]	0.03283338					
29	0.04153504					
[redacted]	0.05368322					
31	0.00001761	0.00016016	0.00016016	-0.0000047	-0.0000429	-0.0000429
[redacted]	0.00104301	0.00949045	0.00949045			
[redacted]	0.02301185	0.21229993	0.21229993			
34	0.02298909	0.21208695	0.21208695			
[redacted]	0.00211748	0.01928003	0.01928003			
[redacted]	0.00014745	0.00134097	0.00134097			
37	-0.0000707	-0.0006432	-0.0128656	-0.0000804	-0.0007316	-0.0146336
[redacted]	0.00075181	0.00683955	0.00683955			
39	0.00191799	0.01746145	0.01746145			
[redacted]	0.02268495	0.20924074	0.20924074			
[redacted]	0.00040629	0.00369541	0.00369541			
42	0.00017009					
[redacted]	0.01247144					
44	0.02559452					
[redacted]	0.03845659					
[redacted]	0.04852478					

Mercury Perkin-Elmer AAWinLab

ID #	Sample_ID	Sam_Date	Sam_Time	Mean_Sig	Mean_ST	Mean_SA	Units	Wt	Dilu
47	STD5=.500ug	12/11/2002	16:38:28	0.064361			mg/L		
48	Reagent Blank	12/11/2002	16:40:00	8.29E-05	0.000659	0.000659	mg/L	10	100
49	0.010 = DL	12/11/2002	16:41:03	0.001334	0.010605	0.010605	mg/L		
50	0.200 = QC STD 2	12/11/2002	16:42:08	0.027294	0.216424	0.216424	mg/L		
51	0.200 = QC STD 3	12/11/2002	16:43:12	0.025753	0.204242	0.204242	mg/L		
52	0.020 = DL	12/11/2002	16:44:20	0.002446	0.019446	0.019446	mg/L		
53	REAGENT BLANK	12/11/2002	16:45:27	0.000102	0.000811	0.000811	mg/L	10	100
54	1181-B-001	12/11/2002	17:10:48	0.000224	0.001784	0.08921	mg/L	10	500
55	1181-B-002	12/11/2002	17:12:21	0.000269	0.002137	0.106863	mg/L	10	500
56	1181-B-003	12/11/2002	17:13:52	9.27E-05	0.000737	0.036834	mg/L	10	500
57	1181-B-004-SPK	12/11/2002	17:15:24	0.02428	0.192586	9.629309	mg/L	10	500
58	1181-B-005	12/11/2002	17:16:56	-4.32E-05	-0.00034	-0.0172	mg/L	10	500
59	1181-B-006	12/11/2002	17:18:32	8.74E-06	6.95E-05	0.002781	mg/L	10	400
60	0.010 = DL	12/11/2002	17:22:45	0.001208	0.009608	0.009608	mg/L	10	500
61	0.200 = QC STD 2	12/11/2002	17:23:49	0.026401	0.209366	0.209366	mg/L	10	500
62	REAGENT BLANK	12/11/2002	17:24:51	0.00099	0.007868	0.007868	mg/L	10	100
63	REAGENT BLANK	12/11/2002	17:25:54	0.001073	0.008533	0.008533	mg/L	10	100
64	1181-C-001	12/11/2002	17:33:36	0.004697	0.037325	1.492996	mg/L	10	400
65	1181-C-002	12/11/2002	17:35:08	0.005245	0.041683	1.667324	mg/L	10	400
66	1181-C-003	12/11/2002	17:36:37	0.00171	0.013591	0.543639	mg/L	10	400
67	1181-C-004-SPK	12/11/2002	17:38:07	0.028794	0.228284	9.131356	mg/L	10	400
68	1181-C-005	12/11/2002	17:39:38	0.002769	0.022008	0.880315	mg/L	10	400
69	1181-C-006	12/11/2002	17:41:08	0.002898	0.023038	0.921507	mg/L	10	400
70	0.010 = DL	12/11/2002	17:42:13	0.001294	0.010286	0.010286	mg/L	10	400
71	0.200 = QC STD 2	12/11/2002	17:43:22	0.024536	0.194608	0.194608	mg/L	10	400
72	REAGENT BLANK	12/11/2002	17:44:24	-9.41E-05	-0.00075	-0.00075	mg/L	10	100
73	1181-BH-001	12/11/2002	17:55:15	0.039077	0.309502	23.21263	mg/L	10	750
74	1181-BH-002	12/11/2002	17:56:49	0.032734	0.259422	19.71608	mg/L	10	760
75	1181-BH-003	12/11/2002	17:58:24	0.061572	0.486584	36.4938	mg/L	10	750
76	1181-BH-004-SPK	12/11/2002	17:59:55	0.086568	0.682437	51.18275	mg/L	10	750
77	0.010 = DL	12/11/2002	18:01:01	0.001094	0.008701	0.008701	mg/L	10	750
78	0.010 = DL	12/11/2002	18:02:07	0.001285	0.010217	0.010217	mg/L	10	750
79	0.200 = QC STD 2	12/11/2002	18:03:13	0.024675	0.195711	0.195711	mg/L	10	750
80	REAGENT BLANK	12/11/2002	18:04:14	2.86E-05	0.000227	0.000227	mg/L	10	100
81	1181-BH-005	12/11/2002	18:05:44	0.000842	0.006692	0.200773	mg/L	10	300
82	1181-BH-006	12/11/2002	18:07:12	0.00026	0.002071	0.062119	mg/L	10	300
83	1181-FH-BLK	12/11/2002	18:17:52	8.49E-05	0.000675	0.006749	mg/L	10	100
84	1181-FH-BLK-SPK	12/11/2002	18:19:24	0.026063	0.206693	5.167319	mg/L	4	100
85	0.010 = DL	12/11/2002	18:20:29	0.001207	0.009592	0.009592	mg/L	4	100
86	0.200 = QC STD 2	12/11/2002	18:21:34	0.024702	0.195926	0.195926	mg/L	4	100
87	REAGENT BLANK	12/11/2002	18:22:36	-6.63E-05	-0.00053	-0.00053	mg/L	10	100
88	1181-FH-001	12/11/2002	18:24:07	0.052292	0.413628	4.13628	mg/L	10	100
89	1181-FH-002	12/11/2002	18:25:43	0.070177	0.554118	5.541175	mg/L	10	100
90	1181-FH-003	12/11/2002	18:27:19	0.06597	0.521109	5.211094	mg/L	10	100
91	1181-FH-004-SPK	12/11/2002	18:28:53	0.096625	0.760969	7.609687	mg/L	10	100
92	1181-FH-005	12/11/2002	18:30:24	-7.39E-05	-0.00059	-0.00588	mg/L	10	100

ID #	Sig 1	Std_U 1	Smp_U 1	Sig 2	Std_U 2	Smp_U 2
[illegible]7	0.06436087					
48	0.00006334	0.00050361	0.00050361	0.0001025	0.000815	0.00081497
49	0.00133392	0.01060458	0.01060458			
[illegible]0	0.02729368	0.21642446	0.21642446			
51	0.02575334	0.2042415	0.2042415			
[illegible]2	0.00244637	0.01944625	0.01944625			
[illegible]3	0.00010198	0.00081083	0.00081083			
54	0.0003198	0.00254267	0.12713353	0.000129	0.0010257	0.05128639
[illegible]5	0.0002558	0.0020338	0.10169012	0.00028182	0.0022407	0.112036
56	0.00012201	0.0009701	0.04850517	0.00006329	0.0005033	0.02516299
[illegible]7	0.02450307	0.19435004	9.71750204	0.02405724	0.1908223	9.54111528
[illegible]8	-0.000024	-0.0001915	-0.0095793	-0.0000624	-0.0004963	-0.024818
59	0.00001224	0.00009734	0.00389383	0.00000524	0.0000417	0.00166834
[illegible]0	0.00120849	0.00960753	0.00960753			
[illegible]1	0.02640126	0.20936647	0.20936647			
62	0.00098969	0.0078682	0.0078682			
[illegible]3	0.00107334	0.00853315	0.00853315			
64	0.00468834	0.03725943	1.49037758	0.00470482	0.0373904	1.49561433
[illegible]5	0.00529526	0.04208025	1.68321009	0.00519526	0.041286	1.65143828
[illegible]6	0.00369264	0.02934927	1.17397092	-0.0002725	-0.0021673	-0.0866933
67	0.02922021	0.23165667	9.26626683	0.02836697	0.2249112	8.99644616
[illegible]8	0.00273358	0.02172869	0.86914783	0.00280384	0.022287	0.89148122
69	0.00296621	0.02357722	0.94308892	0.00283041	0.0224981	0.89992451
[illegible]0	0.00129381	0.0102857	0.0102857			
[illegible]1	0.0245357	0.1946082	0.1946082			
72	-0.0000941	-0.0007486	-0.0007486			
[illegible]3	0.03955373	0.31326018	23.4945135	0.03860099	0.3057433	22.9307505
[illegible]4	0.03291816	0.26087838	19.826757	0.03254947	0.2579659	19.6054069
75	0.06185631	0.48881624	36.6612186	0.06128793	0.4843518	36.3263857
[illegible]6	0.08790825	0.69291046	51.9682846	0.08522819	0.6719628	50.3972126
77	0.00109449	0.00870128	0.00870128			
[illegible]8	0.00128512	0.01021664	0.01021664			
[illegible]9	0.02467504	0.19571071	0.19571071			
80	0.00002859	0.00022733	0.00022733			
[illegible]1	0.00084303	0.00670236	0.20107097	0.00084053	0.0066825	0.2004743
[illegible]2	0.0003129	0.00248781	0.07463445	0.00020795	0.0016534	0.04960274
[illegible]3	0.00008526	0.00067791	0.0067791	0.00008451	0.000672	0.00671985
[illegible]4	0.02641848	0.20950266	5.23756662	0.02570801	0.2038829	5.0970721
85	0.00120657	0.00959229	0.00959229			
[illegible]6	0.02470221	0.19592565	0.19592565			
[illegible]7	-0.0000663	-0.0005274	-0.0005274			
88	0.05270248	0.4168548	4.16854808	0.05188234	0.4104011	4.10401105
[illegible]9	0.07116301	0.56184638	5.61846384	0.06919171	0.5463887	5.46388697
90	0.06685864	0.52808647	5.28086471	0.06508058	0.5141324	5.14132414
[illegible]1	0.09740678	0.76706329	7.6706329	0.0958442	0.754874	7.54874049
[illegible]2	-0.0001021	-0.000812	-0.00812	-0.0000458	-0.0003647	-0.0036473

Mercury Perkin-Elmer AAWinLab

ID #	Sample_ID	Sam_Date	Sam_Time	Mean_Sig	Mean_ST	Mean_SA	Units	Wt	Dilu
93	1181-FH-006	12/11/2002	18:31:53	0.000128	0.001021	0.010215	mg/L	10	100
94	0.010 = DL	12/11/2002	18:38:53	0.001139	0.009053	0.009053	mg/L	10	100
95	0.200 = QC STD 2	12/11/2002	18:39:58	0.024884	0.197367	0.197367	mg/L	10	100
96	REAGENT BLANK	12/11/2002	18:41:04	0.001089	0.008655	0.008655	mg/L	10	100
97	REAGENT BLANK	12/11/2002	18:42:04	3.02E-05	0.00024	0.00024	mg/L	10	100
98	Calib Blank	12/12/2002	16:32:23	0.000463			mg/L		
99	STD1=.100ug	12/12/2002	16:33:25	0.013082			mg/L		
100	STD2=.200ug	12/12/2002	16:34:27	0.026004			mg/L		
101	STD3=.300ug	12/12/2002	16:35:30	0.038258			mg/L		
102	STD4=.400ug	12/12/2002	16:36:34	0.048725			mg/L		
103	STD5=.500ug	12/12/2002	16:37:42	0.064785			mg/L		
104	Reagent Blank	12/12/2002	16:39:15	-7.11E-05	-0.00054	-0.00054	mg/L	10	100
105	0.010 = DL	12/12/2002	16:40:18	0.001276	0.009732	0.009732	mg/L		
106	0.200 = QC STD 2	12/12/2002	16:41:24	0.025551	0.197983	0.197983	mg/L		
107	0.200 = QC STD 3	12/12/2002	16:42:29	0.025936	0.201009	0.201009	mg/L		
108	0.020 = DL	12/12/2002	16:43:35	0.002447	0.018685	0.018685	mg/L		
109	REAGENT BLANK	12/12/2002	16:44:41	7.14E-05	0.000545	0.000545	mg/L	10	100
110	1181-C-003	12/12/2002	17:52:11	0.004495	0.034366	1.374639	mg/L	10	400
111	1181-C-004-SPK	12/12/2002	17:53:45	0.031167	0.242363	9.694534	mg/L	10	400
112	0.010 = DL	12/12/2002	17:57:53	0.001279	0.00976	0.00976	mg/L	2.5	1
113	0.200 = QC STD 2	12/12/2002	17:58:58	0.025841	0.200265	0.200265	mg/L	2.5	1
114	REAGENT BLANK	12/12/2002	18:00:02	6.74E-06	5.14E-05	5.14E-05	mg/L	10	100

ID #	Sig 1	Std_U 1	Smp_U 1	Sig 2	Std_U 2	Smp_U 2
[redacted]3	0.00016341	0.00129925	0.01299251	0.00009354	0.0007437	0.00743744
[redacted]4	0.00113867	0.00905252	0.00905252			
[redacted]95	0.02488444	0.19736749	0.19736749			
[redacted]6	0.00108861	0.00865458	0.00865458			
[redacted]97	0.00003018	0.00024002	0.00024002			
[redacted]8	0.00046252					
[redacted]9	0.01308209					
[redacted]100	0.02600374					
[redacted]01	0.03825789					
[redacted]102	0.04872504					
[redacted]103	0.06478512					
[redacted]04	-0.0001247	-0.000951	-0.000951	-0.0000176	-0.0001341	-0.0001341
[redacted]105	0.0012755	0.00973214	0.00973214			
[redacted]06	0.02555141	0.19798339	0.19798339			
[redacted]107	0.02593553	0.20100902	0.20100902			
[redacted]108	0.00244702	0.0186846	0.0186846			
[redacted]09	0.00007144	0.0005447	0.0005447			
[redacted]110	0.00455723	0.03484382	1.39375283	0.00443259	0.0338881	1.35552461
[redacted]11	0.03146253	0.24470998	9.78839932	0.03087083	0.2400167	9.60066773
[redacted]12	0.00127915	0.00976001	0.00976001			
[redacted]113	0.02584106	0.20026475	0.20026475			
[redacted]14	0.00000674	0.0000514	0.0000514			

OPERATING DATA

G

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 12/3/02
Start Time: 7:47:00
End Time: 9:58:00

	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	GAL	%	DEG F	" H2O	" H2O
Unit 1	493.44	320.16	31.74	25.26	6.48	18.26	304.28	9.16	-11.33
Unit 2	523.08	319.76	43.22	36.82	6.40	13.69	294.45	6.24	-10.94
Unit 3	515.93	320.11	40.21	31.86	8.35	14.43	305.95	8.25	-11.90

	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	184.93	878.15	829.83	80.35	-0.10	271.94	1077.53	7.83	184.01
Unit 2	193.39	859.31	829.91	74.69	-0.10	274.27	1172.40	12.15	179.26
Unit 3	188.92	903.14	828.57	74.95	-0.10	278.74	1205.65	9.63	184.47

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 12/3/02
Start Time: 9:59:00
End Time: 12:09:00

	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	GAL	%	DEG F	" H2O	" H2O
Unit 1	501.96	319.95	34.39	23.58	10.81	16.84	309.16	9.44	-11.67
Unit 2	516.14	319.92	40.25	23.22	17.03	14.54	287.03	6.98	-11.25
Unit 3	517.89	320.03	41.45	30.98	10.47	13.99	305.85	8.14	-11.77

	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	185.85	878.79	827.09	82.07	-0.10	272.57	1061.68	9.14	185.17
Unit 2	198.49	859.80	829.68	73.01	-0.08	275.09	1182.99	7.00	184.12
Unit 3	189.40	903.17	827.23	74.96	-0.10	279.50	1208.50	11.58	184.88

Wheelabrator
NORTH BROWARD
Emission Test Log

Date: 12/3/02
Start Time: 12:10:00
End Time: 12:37:00

	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	GAL	%	DEG F	" H2O	" H2O
Unit 1	503.55	320.08	33.99	26.89	7.10	17.04	309.77	9.17	-11.38
Unit 2	516.27	319.78	40.64	32.08	8.56	14.35	282.87	5.10	-9.39
Unit 3	518.71	320.19	43.25	32.62	10.64	13.39	305.66	8.31	-11.83

	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	176.23	878.50	828.82	83.03	-0.11	272.55	1065.53	9.28	183.78
Unit 2	188.47	859.42	830.10	70.30	-0.17	275.22	1192.19	8.81	185.15
Unit 3	178.03	902.22	827.71	75.76	-0.10	279.62	1220.86	8.23	183.24

Plant Name: NBWD

General Average Report

Reporting Period: 12/03/2002 to 12/03/2002

Site Name: UNIT3

Data Averaging Type: 1m

Time of Report: 12/04/02 15:48

Rolling Average Interval: 1

Date	Time	STMDISP3 (K#/HR)
12/03/02	13:22	181.4
	13:23	182.2
	13:24	182.6
	13:25	182.2
	13:26	182.4
	13:27	181.9
	13:28	182.1
	13:29	183.7
	13:30	183.2
	13:31	182.0
	13:32	180.8
	13:33	180.3
	13:34	182.0
	13:35	183.4
	13:36	182.9
	13:37	184.6
	13:38	185.1
	13:39	185.4
	13:40	184.7
	13:41	183.7
	13:42	183.6
	13:43	183.3
	13:44	183.8
	13:45	185.7
	13:46	188.0
	13:47	188.5
	13:48	186.5
	13:49	185.5
	13:50	182.7
	13:51	181.2
	13:52	181.6
	13:53	181.3
	13:54	182.1
	13:55	182.7
	13:56	183.6
	13:57	183.4
	13:58	181.6
	13:59	180.6
	14:00	181.3
	14:01	183.9
	14:02	183.3
	14:03	181.1
	14:04	181.8
	14:05	181.7
	14:06	180.5
	14:07	179.1
	14:08	178.1
	14:09	175.9
	14:10	173.7
	14:11	171.0

General Average Report

Reporting Period: 12/03/2002 to 12/03/2002

te Name: UNIT3
ta Averaging Type: 1m

Time of Report: 12/04/02 15:48
Rolling Average Interval: 1

Date	Time	STMDISP3 (K#/HR)
12/03/02	14:12	171.7
	14:13	175.3
	14:14	176.3
	14:15	176.8
	14:16	175.7
	14:17	173.6
	14:18	171.9
	14:19	171.3
	14:20	171.6
	14:21	171.0
	14:22	168.8

Average =	180.6
eometric Avg. =	180.6
Maximum =	188.5
Minimum =	168.8
ossible Values =	61
cluded Values =	61
Total =	11017.6

- excluded values (missing, OOC, invalid, suspect)
< - missing
T - out-of-control
- invalid
- suspect
H - exceedance
- stack not operating
- invalid (PADER)
U - missing data substituted
-999 - missing value
88 - value could not be calculated

Plant Name: NBWD

General Average Report

Reporting Period: 12/03/2002 to 12/03/2002

Site Name: UNIT3

Time of Report: 12/04/02 15:49

Data Averaging Type: 1m

Rolling Average Interval: 1

Date	Time	STMDISP3 (K#/HR)
12/03/02	15:38	182.5
	15:39	183.5
	15:40	184.1
	15:41	183.1
	15:42	182.5
	15:43	182.2
	15:44	183.4
	15:45	184.9
	15:46	184.4
	15:47	183.4
	15:48	184.6
	15:49	185.9
	15:50	183.8
	15:51	182.3
	15:52	181.5
	15:53	183.0
	15:54	184.3
	15:55	185.1
	15:56	184.3
	15:57	183.8
	15:58	184.2
	15:59	187.0
	16:00	186.4
	16:01	188.3
	16:02	187.8
	16:03	185.3
	16:04	185.0
	16:05	186.3
	16:06	187.3
	16:07	185.9
	16:08	186.8
	16:09	187.7
	16:10	185.0
	16:11	188.3
	16:12	191.1
	16:13	192.1
	16:14	191.2
	16:15	189.3
	16:16	189.0
	16:17	189.8
	16:18	189.2
	16:19	187.5
	16:20	185.6
	16:21	185.4

Average =	185.8
Geometric Avg. =	185.8
Maximum =	192.1
Minimum =	181.5
Possible Values =	44
Included Values =	44
Total =	8173.9

* - excluded values (missing, OOC, invalid, suspect)

< - missing

T - out-of-control

I - invalid

Plant Name: NBWD

General Average Report

Reporting Period: 12/03/2002 to 12/03/2002

Time of Report: 12/16/02 13:10

Rolling Average Interval: 1

[redacted] Name: UNIT3

Data Averaging Type: 1m

Date	Time	FFTMPT_3 (DEGF)
12/03/02	12:10	318
	12:11	322
	12:12	323
	12:13	322
	12:14	321
	12:15	319
	12:16	318
	12:17	318
	12:18	319
	12:19	320
	12:20	322
	12:21	323
	12:22	321
	12:23	320
	12:24	319
	12:25	319
	12:26	318
	12:27	317
	12:28	318
	12:29	319
	12:30	320
	12:31	321
	12:32	320
	12:33	319
	12:34	319
	12:35	319
	12:36	319
	12:37	321
	12:38	321
	12:39	317
	12:40	308

Average =	319
Geometric Avg. =	319
Maximum =	323
Minimum =	308
Possible Values =	31
Included Values =	31
Total =	9901

* - excluded values (missing, OOC, invalid, suspect)
[illegible] - missing
[illegible] - out-of-control
I - invalid
[illegible] - suspect
[illegible] - exceedance
[illegible] - stack not operating
S - invalid (PADER)
[illegible] - missing data substituted
-999 - missing value
-888 - value could not be calculated

Plant Name: NBWD
General Average Report
Reporting Period: 12/03/2002 to 12/03/2002

Time of Report: 12/16/02 13:10
Rolling Average Interval: 1

Site Name: UNIT3
Data Averaging Type: 1m

Date	Time	FFTMPI_3 (DEGF)
12/03/02	13:22	321
	13:23	322
	13:24	322
	13:25	322
	13:26	323
	13:27	322
	13:28	322
	13:29	322
	13:30	322
	13:31	321
	13:32	321
	13:33	321
	13:34	322
	13:35	322
	13:36	322
	13:37	322
	13:38	322
	13:39	322
	13:40	321
	13:41	320
	13:42	320
	13:43	320
	13:44	320
	13:45	321
	13:46	321
	13:47	321
	13:48	320
	13:49	320
	13:50	319
	13:51	319
	13:52	319
	13:53	319
	13:54	319
	13:55	319
	13:56	320
	13:57	320
	13:58	320
	13:59	319
	14:00	319
	14:01	320
	14:02	321
	14:03	321
	14:04	321
	14:05	322
	14:06	322
	14:07	321
	14:08	320
	14:09	320
	14:10	319
	14:11	319

Plant Name: NBWD
General Average Report
Reporting Period: 12/03/2002 to 12/03/2002

Time of Report: 12/16/02 13:10
Rolling Average Interval: 1

[redacted]tc Name: UNIT3
Data Averaging Type: 1m

Date	Time	FPTMPI_3 (DEGF)
12/03/02	14:12	320
	14:13	319
	14:14	319
	14:15	318
	14:16	317
	14:17	317
	14:18	318
	14:19	319
	14:20	319
	14:21	319
	14:22	320
	14:23	319
	14:24	319
	14:25	317
	14:26	315
	14:27	312
	14:28	311
	14:29	311
	14:30	313
	14:31	315
	14:32	317
	14:33	317
	14:34	318
	14:35	318
	14:36	318
	14:37	317
	14:38	317
	14:39	316
	14:40	317
	14:41	318
	14:42	319
	14:43	319
	14:44	319
	14:45	318
	14:46	317
	14:47	318
	14:48	317
	14:49	317
	14:50	318
	14:51	318
	14:52	319
	14:53	319
	14:54	319
	14:55	319
	14:56	319
	14:57	319
	14:58	318
	14:59	317
	15:00	317
	15:01	318

Plant Name: NBWD
General Average Report
Reporting Period: 12/03/2002 to 12/03/2002

Time of Report: 12/16/02 13:10
Rolling Average Interval: 1

Site Name: UNIT3
Data Averaging Type: 1m

Date	Time	FFTMPI_3 (DEGF)
12/03/02	15:02	318
	15:03	319
	15:04	319
	15:05	318
	15:06	318
	15:07	318
	15:08	317
	15:09	316
	15:10	315
	15:11	315
	15:12	315
	15:13	314
	15:14	313
	15:15	313
	15:16	313
	15:17	314
	15:18	314
	15:19	314
	15:20	314
	15:21	315
	15:22	316
	15:23	316
	15:24	317
	15:25	317
	15:26	319
	15:27	320
	15:28	321
	15:29	322
	15:30	322
	15:31	324
	15:32	325
	15:33	326
	15:34	328
	15:35	328
	15:36	326
	15:37	324
	15:38	322
	15:39	321
	15:40	320
	15:41	320
	15:42	320
	15:43	320
	15:44	321
	15:45	320
	15:46	321
	15:47	320
	15:48	320
	15:49	321
	15:50	320
	15:51	319

[redacted]e Name: UNIT3
Data Averaging Type: 1m

Time of Report: 12/16/02 13:10
Rolling Average Interval: 1

Date	Time	FFTMPI_3 (DEGF)
12/03/02	15:52	319
	15:53	320
	15:54	320
	15:55	320
	15:56	320
	15:57	321
	15:58	321
	15:59	321
	16:00	320
	16:01	319
	16:02	319
	16:03	319
	16:04	319
	16:05	319
	16:06	319
	16:07	319
	16:08	319
	16:09	319
	16:10	319
	16:11	319
	16:12	319
	16:13	319
	16:14	319
	16:15	319
	16:16	318
	16:17	318
	16:18	319
	16:19	320
	16:20	321
	16:21	322

Average =	319
Geometric Avg. =	319
Maximum =	328
Minimum =	311
Possible Values =	180
Included Values =	180
Total =	57429

* - excluded values (missing, ooc, invalid, suspect)
< - missing
[redacted] - out-of-control
[redacted] - invalid
S - suspect
[redacted] - exceedance
[redacted] - stack not operating
[redacted] - invalid (PADER)
U - missing data substituted
-999 - missing value
-888 - value could not be calculated