# Report on Mercury Testing

Wheelabrator North Broward, Inc.
Unit 3 FF Outlet
Pompano Beach, FL

CleanAir Project No: 10955-7
Revision 0: January 6, 2011

**Wheelabrator North Broward Inc.**
A Waste Management Company
2600 N.W. 48th Street
Pompano Beach, FL 33073



January 10, 2011

CERTIFIED MAIL #70031010000154667654

Mr. Lennon Anderson
Air Program Administrator
Florida Department of Environmental Protection
Southeast District
400 North Congress Ave., Suite 200
West Palm Beach, FL 33401

Re: Wheelabrator North Broward
F.A.C. 62-296.416 Quarterly Mercury Stack Testing
Fourth Quarter of 2010, Report Submittal

Dear Mr. Anderson:

As required by F.A.C. 62-296.416, please find enclosed the 2010 fourth quarter report on mercury stack testing which was conducted on Unit #3.

I, the undersigned, am a responsible official, as defined in Rule 62-210.200, F.A.C., of the Title V source addressed in this submittal. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements and information in this document are true, accurate and complete.

If there are any questions, please contact this office at (954) 971-8701.

Sincerely,

Jim Epsilantis

Jim Epsilantis
Acting Plant Manager

cc: USEPA, Region IV, Pesticides and Toxics Management Division, Air & EPCRA Enforcement Branch, Air Enforcement Section CERTIFIED MAIL #70031010000154667661
FDEP, Tallahassee, Bureau of Air Regulation, New Source Review Section, CERTIFIED MAIL #70031010000154667678
Broward County Department of Planning and Environmental Protection, Air Quality Division CERTIFIED MAIL #70031010000154667685
Chuck Faller (with)
Tim Porter (without)
Rob French – MPI - (with)

WM
WASTE MANAGEMENT

CleanAir.

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Wheelabrator North Broward, Inc.
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Pompano Beach, FL 33073



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# REPORT ON MERCURY TESTING

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

Client Reference No: Service Agreement
CleanAir Project No: 10955-7
Revision 0: January 6, 2011

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

Prepared by,

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Project Manager
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Reviewed by,

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## REVISION HISTORY



# REPORT ON MERCURY TESTING

***DRAFT REPORT REVISION HISTORY***

| Revision: | Date | Pages | Comments |
|---|---|---|---|
| D0a | 01/04/11 | All | Draft version of original document. |
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***FINAL REPORT REVISION HISTORY***

| Revision: | Date | Pages | Comments |
|---|---|---|---|
| 0 | 01/06/11 | All | Final version of original document. |
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## 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 (FDEP). Wheelabrator North Broward, Inc. contracted Clean Air Engineering (CleanAir) to perform a compliance test program at its municipal waste combustor (MWC) facility in Pompano Beach, Florida. Testing was conducted in accordance with 40 CFR 60 Subpart Cb and applicable sections of PSD–FL-112(B) and PA86-22. The sampling was conducted at the Unit 3 Fabric Filter (FF) Outlet on December 8, 2010.

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:

B. Hooper - Wheelabrator
C. Slimp - CleanAir
K. Sullivan - CleanAir

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

All equipment utilized for testing was manufactured by Clean Air Engineering.

Table 1-1 outlines the schedule adhered to during the test program. Table 1-2 (on page 1-2) summarizes the results of the test program.

**Table 1-1:**
**Schedule of Activities**

| Run Number | Location | Method | Analyte | Date | Start Time | End Time |
|---|---|---|---|---|---|---|
| 1 | Unit 3 FF Outlet | USEPA Method 29 | Trace Metals | 12/08/10 | 08:04 | 10:19 |
| 2 | Unit 3 FF Outlet | USEPA Method 29 | Trace Metals | 12/08/10 | 10:45 | 12:53 |
| 3 | Unit 3 FF Outlet | USEPA Method 29 | Trace Metals | 12/08/10 | 13:10 | 15:15 |

**Table 1-2:**
**Summary of Test Results**

| Source<br>Constituent | Sampling Method | Average Emission | Permit Limit[1] |
|---|---|---|---|
| Unit 3 FF Outlet | | | |
| Mercury (µg/dscm @7% $O_2$) | EPA M29 | 5.3 | 50 |

[1] Limit obtained from the facility's Title V Permit No. 0570127-005-AV and Subpart Cb as of April 28, 2009.

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).

*End of Section 1 – Project Overview*

## RESULTS



**Table 2-1:**
**Unit 3 FF Outlet – Mercury**

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Process Conditions** | | | | | |
| $R_P$ | Steam Production Rate (Klbs/hour) | 180 | 180 | 180 | **180** |
| $P_1$ | SDA Outlet Temperature (°F) | 320 | 320 | 320 | **320** |
| **Gas Conditions** | | | | | |
| $O_2$ | Oxygen (dry volume %) | 10.7 | 10.7 | 10.1 | **10.5** |
| $CO_2$ | Carbon dioxide (dry volume %) | 8.3 | 8.2 | 8.9 | **8.5** |
| $T_s$ | Sample temperature (°F) | 306 | 307 | 309 | **307** |
| $B_w$ | Actual water vapor in gas (% by volume) | 19.8 | 19.0 | 19.4 | **19.4** |
| **Gas Flow Rate** | | | | | |
| $Q_a$ | Volumetric flow rate, actual (acfm) | 186,645 | 187,110 | 181,294 | **185,016** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dscfm) | 100,911 | 102,101 | 98,113 | **100,375** |
| **Sampling Data** | | | | | |
| $V_{mstd}$ | Volume metered, standard (dscf) | 79.428 | 79.457 | 76.424 | **78.436** |
| %I | Isokinetic sampling (%) | 100.7 | 99.5 | 99.6 | **99.9** |
| **Laboratory Data** | | | | | |
| $m_{n\text{-}1b}$ | Fraction 1B (µg) | <0.1000 | <0.1000 | <0.1000 | |
| $m_{n\text{-}2b}$ | Fraction 2B (µg) | 7.9536 | 7.4497 | 10.7533 | |
| $m_{n\text{-}3a}$ | Fraction 3A (µg) | <0.2000 | 0.3763 | <0.2000 | |
| $m_{n\text{-}3b}$ | Fraction 3B (µg) | <0.5000 | <0.5000 | <0.5000 | |
| $m_{n\text{-}3c}$ | Fraction 3C (µg) | <0.4000 | <0.4000 | <0.4000 | |
| $m_n$ | Total matter corrected for allowable blanks (µg) | 7.9536 | 7.8260 | 10.7533 | |
| **Mercury Results - Total** | | | | | |
| $C_{sd}$ | Concentration (lb/dscf) | 2.21E-10 | 2.17E-10 | 3.10E-10 | **2.49E-10** |
| $C_{sd7}$ | Concentration @7% $O_2$ (lb/dscf) | 3.02E-10 | 2.97E-10 | 4.01E-10 | **3.33E-10** |
| $C_{sd}$ | Concentration (µg/dscm) | 3.5 | 3.5 | 5.0 | **4.0** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/dscm) | 4.8 | 4.8 | 6.4 | **5.3** |
| $E_{lb/hr}$ | Rate (lb/hr) | 1.34E-03 | 1.33E-03 | 1.83E-03 | **1.50E-03** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | 4.34E-06 | 4.27E-06 | 5.76E-06 | **4.79E-06** |

## RESULTS



**Table 2-2:**
**Quality Assurance and Quality Control**

| Run Number | | FH Front Half | BH $H_2O_2/HNO_4$ | A Empty Impinger | B $KMnO_4$ | C HCl |
|---|---|---|---|---|---|---|
| | | **RPD RESULTS** | | | | |
| **U3 FF Outlet R1** | | NA | 3.0% | NA | NA | NA |
| **U3 FF Outlet R2** | | NA | 4.5% | 7.0% | NA | NA |
| **U3 FF Outlet R3** | | NA | 4.8% | NA | NA | NA |
| **Field Blank** | | NA | NA | NA | NA | NA |
| **Reagent Blank** | | NA | NA | NA | NA | NA |
| | | **Sample Spike and Recovery** | | | | |
| **U3 FF Outlet R3** | **#1** | 115% | 106% | 117% | 112% | 105% |
| | **#2** | 113% | 110% | 109% | 113% | 94% |
| | | **Blanks** | | | | |
| **Field Blank** | **#1** | < 0.1 | < 0.3 | < 0.2 | < 0.5 | < 0.4 |
| | **#2** | < 0.1 | < 0.3 | < 0.2 | < 0.5 | < 0.4 |
| **Reagent Blank** | **#1** | < 0.1 | < 0.2 | < 0.2 | < 0.5 | < 0.4 |
| | **#2** | < 0.1 | < 0.2 | < 0.2 | < 0.5 | < 0.4 |
| **Meter Post Cal** | | -0.4% | | | | |

*End of Section 2 – Results*

## DESCRIPTION OF INSTALLATION



### PROCESS DESCRIPTION

The North Broward Resource Recovery facility operates three (3) 750 tons per day municipal refuse-fired, water-wall boiler trains. The trains were manufactured by Babcock & Wilcox to produce electricity for sale to a local utility company. Each boiler is equipped with a spray dryer absorber (SDA) for acid gas removal, followed by an FF baghouse for the control of particulate emissions. Wheelabrator Air Pollution Control, Inc. supplies the control equipment. Each FF baghouse is followed by an induced draft fan that 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 3-2 (on page 3-2).

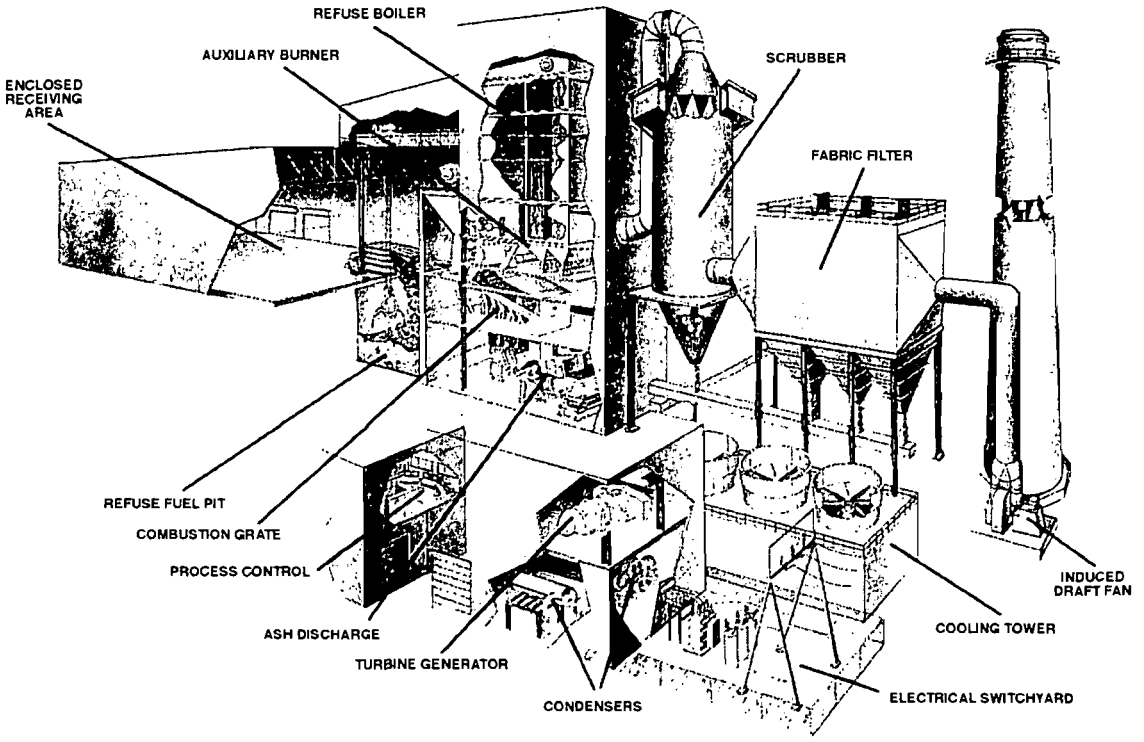



**Figure 3-1: General Process Schematic**

## DESCRIPTION OF INSTALLATION



### PROCESS DESCRIPTION (CONTINUED)

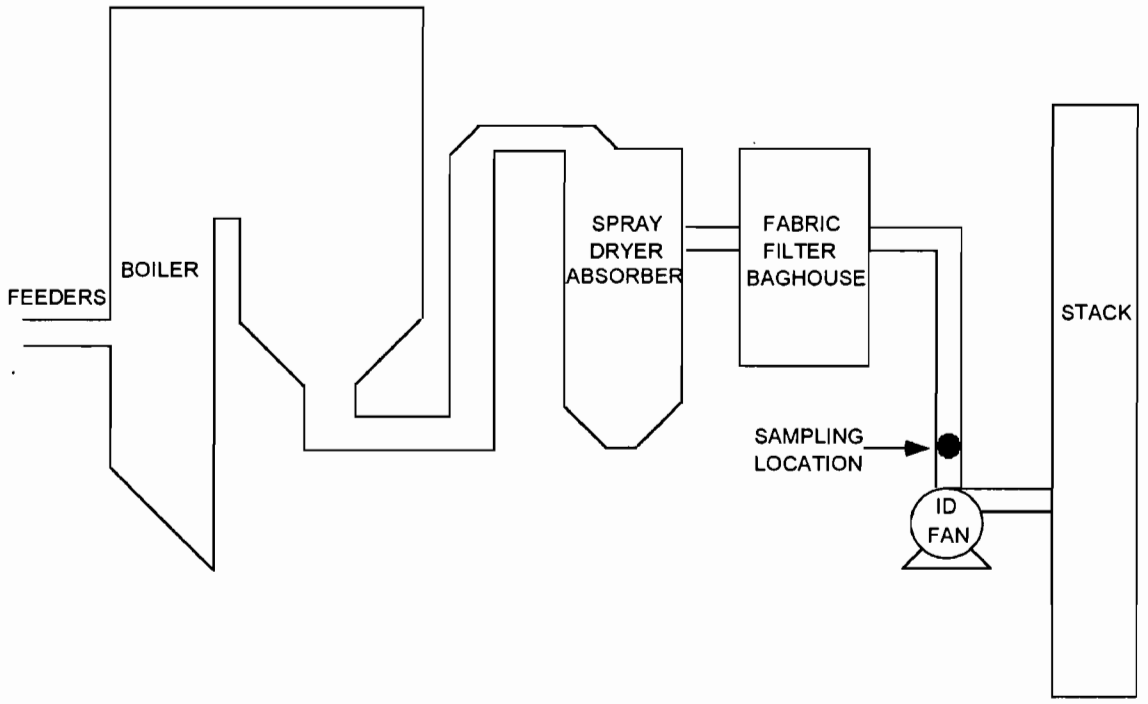



**Figure 3-2: Process Schematic**

## DESCRIPTION OF INSTALLATION



### DESCRIPTION OF SAMPLING LOCATION

The sampling point location was determined according to EPA Method 1.

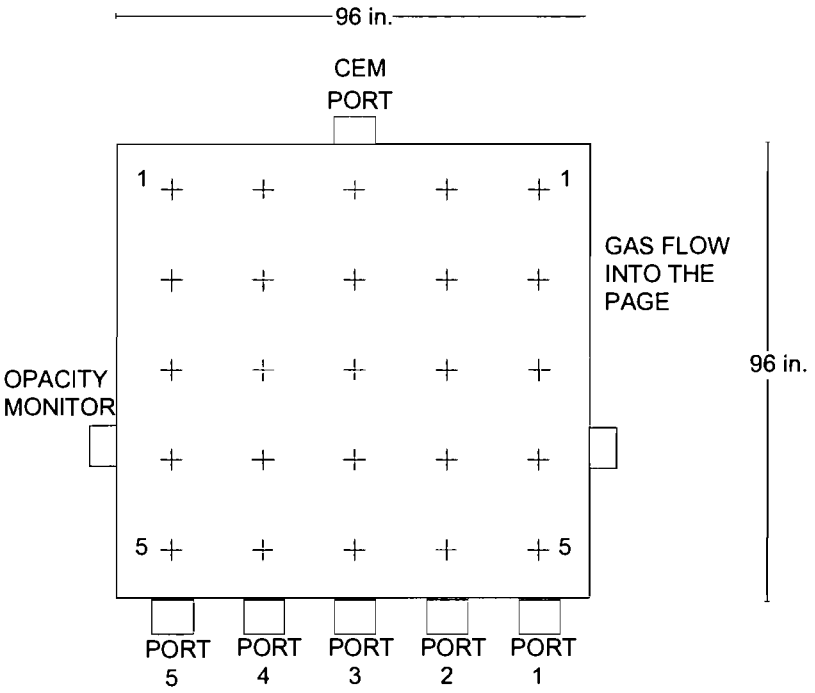
Table 3-1 outlines the sampling point configurations. Figure 3-3 (on page 3-4) illustrates the sampling points and orientation of sampling ports for the source tested in the program.

**Table 3-1:**
**Sampling Points**

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

## DESCRIPTION OF INSTALLATION

### DESCRIPTION OF SAMPLING LOCATION (CONTINUED)




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

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

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

*End of Section 3 – Description of Installation*

## METHODOLOGY



Clean Air Engineering 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.

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

CleanAir followed specific quality assurance and quality control (QA/QC) procedures as outlined in the individual methods and in EPA "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III Stationary Source-Specific Methods", EPA/600/R-94/038C. Additional QA/QC methods, as prescribed in CleanAir's internal Quality Manual, were also followed. Results of all QA/QC activities performed by CleanAir are summarized in Appendix D.

*End of Section 4 –Methodology*

## APPENDIX

## TEST METHOD SPECIFICATIONS

A

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## Specification Sheet for EPA Method 29

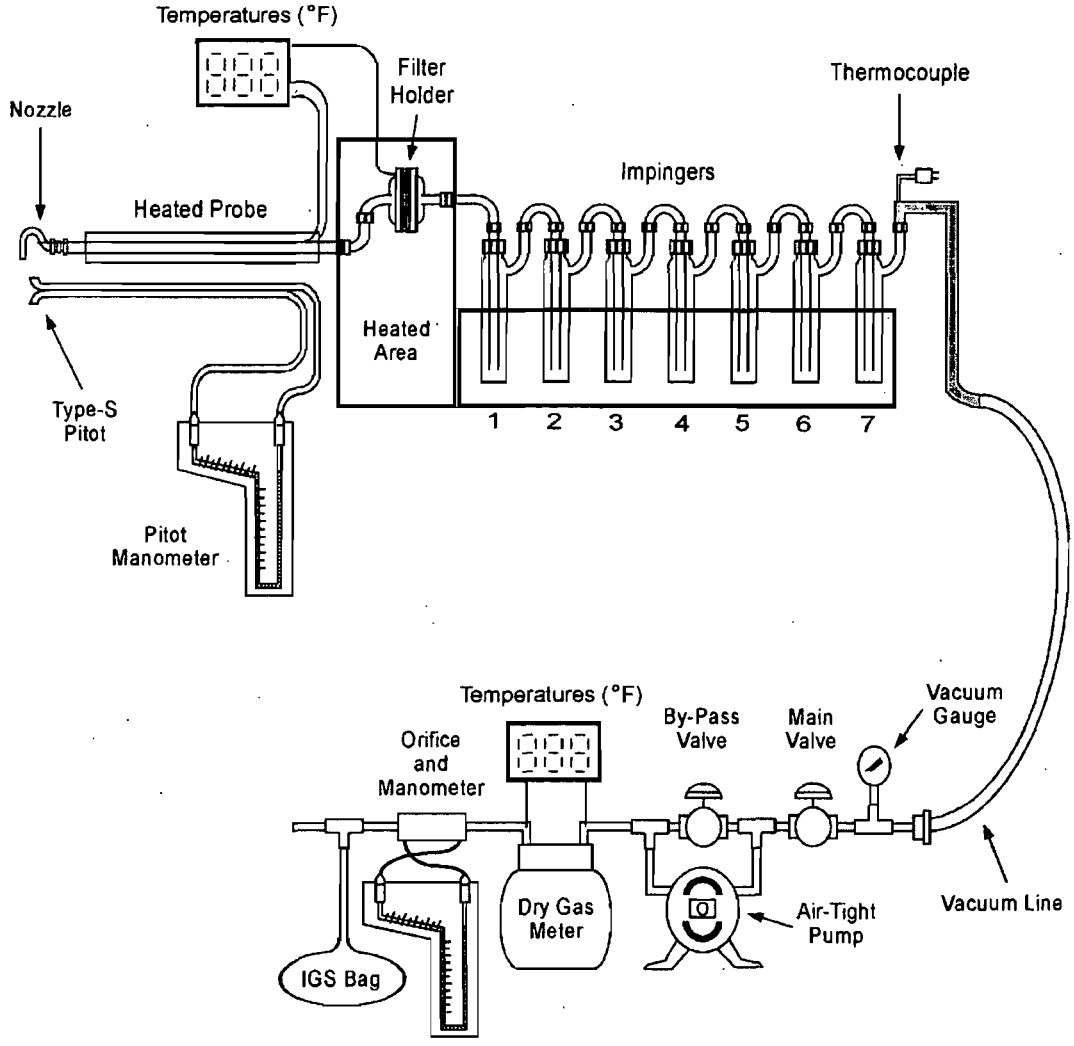
| | |
|---|---|
| Source Location Name(s) | Unit 3 FF Outlet |
| Pollutant(s) to be Determined | Mercury |
| Other Parameters to be Determined from Train | Gas Density, Moisture, Flow Rate |

| | Standard Method Specification | Actual Specification Used |
|---|---|---|
| **Pollutant Sampling Information** | | |
| Duration of Run | N/A | 125 minutes |
| No. of Sample Traverse Points | N/A | 25 |
| Sample Time per Point | N/A | 5 minutes |
| Sampling Rate | Isokinetic (90-110%) | Isokinetic (90-110%) |
| **Sampling Probe** | | |
| Nozzle Material | Borosilicate or Quartz Glass | Borosilicate Glass |
| Nozzle Design | Button-Hook or Elbow | Button-Hook |
| Probe Liner Material | Borosilicate or Quartz Glass | Borosilicate Glass |
| Effective Probe Length | N/A | 8 feet |
| Probe Temperature Set-Point | 248°F±25°F | 248°F±25°F |
| **Velocity Measuring Equipment** | | |
| Pitot Tube Design | Type S | Type S |
| Pitot Tube Coefficient | N/A | 0.82 |
| Pitot Tube Calibration by | Geometric or Wind Tunnel | Wind-Tunnel |
| Pitot Tube Attachment | Attached to Probe | Attached to Probe |
| **Metering System Console** | | |
| Meter Type | Dry Gas Meter | Dry Gas Meter |
| Meter Accuracy | ±2% | ±1% |
| Meter Resolution | N/A | 0.01 cubic feet |
| Meter Size | N/A | 0.1 dcf/revolution |
| Meter Calibrated Against | Wet Test Meter or Standard DGM | Wet Test Meter |
| Pump Type | N/A | Rotary Vane |
| Temperature Measurements | N/A | Type K Thermocouple/Pyrometer |
| Temperature Resolution | 5.4°F | 1.0°F |
| ΔP Differential Pressure Gauge | Inclined Manometer or Equivalent | Inclined Manometer |
| ΔH Differential Pressure Gauge | Inclined Manometer or Equivalent | Inclined Manometer |
| Barometer | Mercury or Aneroid | Digital Barometer calibrated w/Mercury Aneroid |
| **Filter Description** | | |
| Filter Location | After Probe | Exit of Probe |
| Filter Holder Material | Borosilicate Glass | Borosilicate Glass |
| Filter Support Material | Teflon (or other non-metallic) | Teflon |
| Cyclone Material | N/A | None |
| Filter Heater Set-Point | 248°F±25°F | 248°F±25°F |
| Filter Material | Quartz or Glass Fiber | Quartz Fiber |
| **Other Components** | | |
| Description | N/A | N/A |
| Location | N/A | N/A |
| Operating Temperature | N/A | N/A |

## Specification Sheet for EPA Method 29

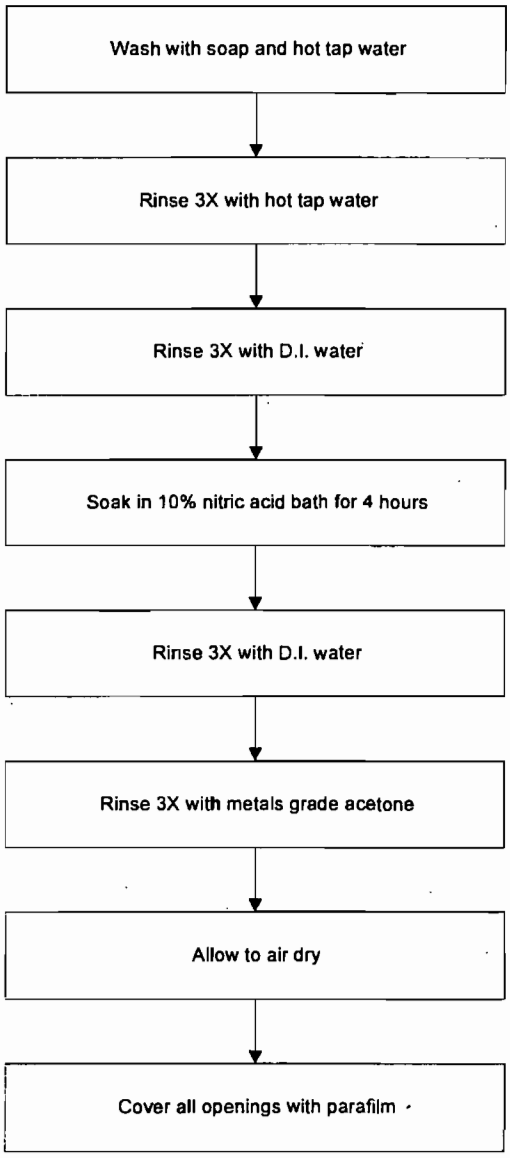
| | Standard Method Specification | Actual Specification Used |
|---|---|---|
| **Impinger Train Description** | | |
| Type of Glassware Connections | Ground Glass or Equivalent | Screw Joint with Silicone Gasket |
| Connection to Probe or Filter by | Direct Glass Connection | Direct Glass Connection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

# EPA Method 29
# Sampling Train Configuration




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

# EPA Method 29
# Glassware Preparation Procedures



# EPA Method 29
## Sample Recovery Flowchart
**(Includes Mercury)**

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

**Container 1**
**Tared Quartz Filter**
**Petri Dish**

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

Remove any particulate or filter fiber to sample container

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

**Container 3**
**Probe Rinse**
**250 ml Polyethylene**

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

Brush/rinse 3X with a total of 100 ml 0.1N $HNO_3$

Visual Inspection

Label container and measure volume by weight

**Container 4**
**1000 ml Polyethylene**

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

Measure impinger volume by weight

Transfer to sample container

Rinse each piece 3X with a total of 100 ml 0.1N $HNO_3$

Visual Inspection

Label container and measure volume by weight

**Container 5A**
**250 ml Polyethylene**

**Impinger 4 and U-bend**

Measure impinger volume by weight to within 0.5 ml

Transfer to sample container

Rinse with 100 ml of 0.1N $HNO_3$

Visual Inspection

Label container and measure volume by weight

**Container 5B**
**950 ml Glass**

**Impingers 5, 6 and U-bends**

Measure impinger volume by weight

Transfer to sample container

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

Rinse 3X with 100 ml of water

Visual Inspection

Label container and measure volume by weight

**Container 6**
**Silica Gel**

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

Recycle silica gel

**Container 5C**
**250 ml Glass**

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

Pour HCl rinse into bottle containing 200 ml of water

Label container and measure volume by weight

**Container 8A**
**Nitric Acid Blank**
**1000 ml Plastic**

300 ml of 0.1N $HNO_3$

**Container 8B**
**Water Blank**
**250 ml Plastic**

100 ml of water

**Container 9**
**5%$HNO_3$/10%$H_2O_2$ Blank**
**500 ml Plastic**

200 ml of absorbing solution

**Container 10***
**Permanganate Blank**
**500 ml Glass**

100 ml $KMnO_4$ solution

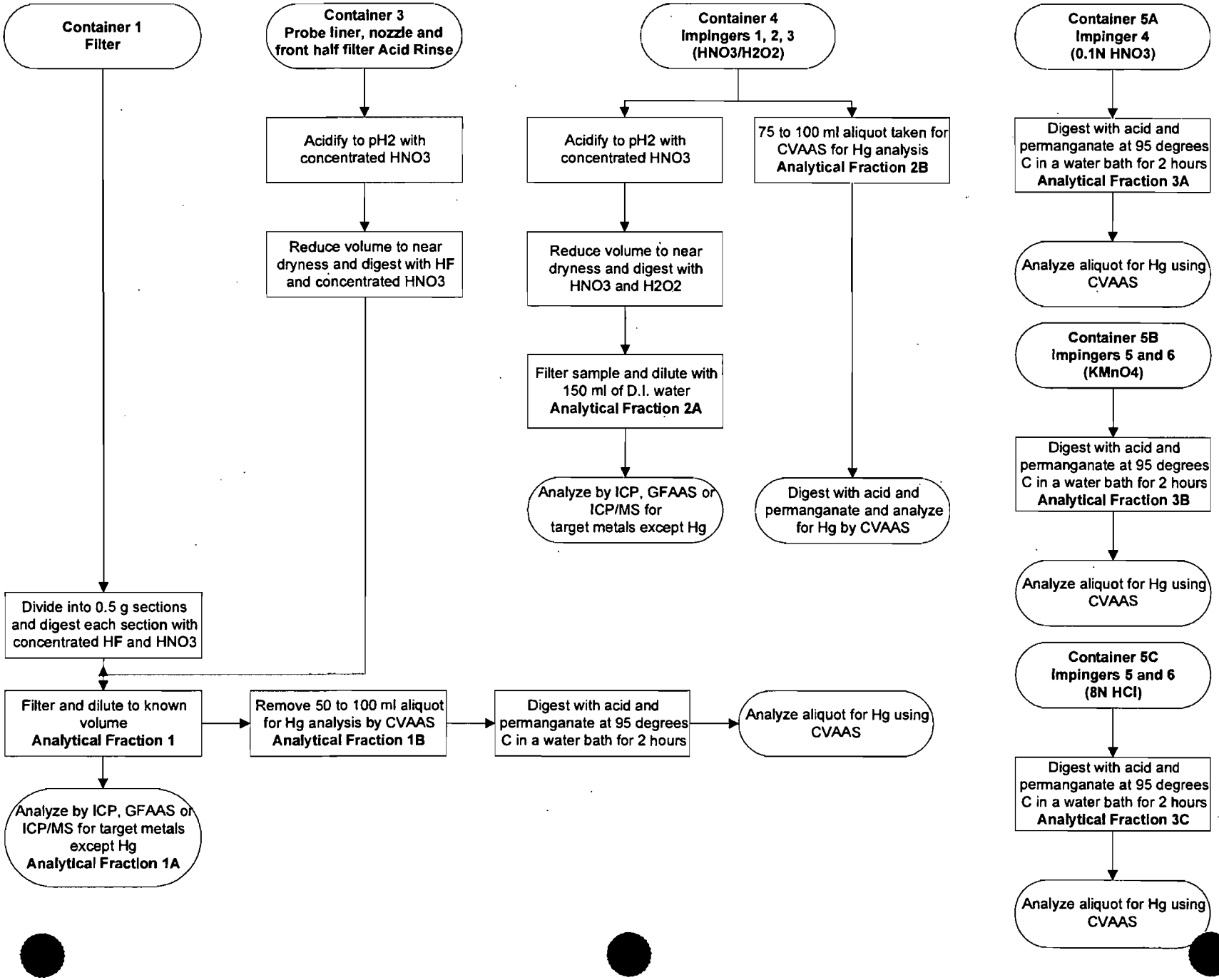
**Container 11**
**HCl Rinse Blank**
**250 ml Glass**

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

**Container 12**
**Filter Blanks**
**Petri Dish**

3 clean, unused filters

# EPA Method 29
## Analytical Flowchart
(includes Mercury)



## SAMPLE CALCULATIONS

B

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

**Sample data taken from Run 1**

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

122110 120611

**1.** Volume of water collected (wscf)

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

Where:

| | | | | |
|---|---|---|---|---|
| $V_{lc}$ | = total volume of liquid collected in impingers and silica gel (ml) | = | 416.5 | ml |
| 0.04706 | = ideal gas conversion factor ($ft^3$ water vapor/ml or gm) | = | 0.04706 | $ft^3$/ml |
| $V_{wstd}$ | = volume of water vapor collected at standard conditions ($ft^3$) | = | 19.60 | $ft^3$ |

**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) | = | 30.04 | in. Hg |
| $T_m$ | = average dry gas meter temperature (°F) | = | 51.12 | °F |
| $V_m$ | = volume of gas sample through the dry gas meter at meter conditions (dcf) | = | 76.69 | dcf |
| $Y_d$ | = gas meter correction factor (dimensionless) | = | 0.9960 | |
| $\Delta H$ | = average pressure drop across meter box orifice (in. $H_2O$) | = | 1.22 | in. $H_2O$ |
| 17.64 | = standard temperature to pressure ratio (°R/in. Hg) | = | 17.64 | °R/in. Hg |
| 13.6 | = conversion factor (in. $H_2O$/in. Hg) | = | 13.6 | in.$H_2O$/in. Hg |
| 460 | = °F to °R conversion constant | = | 460 | |
| $V_{mstd}$ | = volume of gas sampled through the dry gas meter at standard conditions (dscf) | = | 79.428 | 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) | = | 30.04 | in. Hg |
| $P_g$ | = sample gas static pressure (in. $H_2O$) | = | -10.70 | 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) | = | 29.25 | in. Hg |







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**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) | = | 305.84 | °F |
| 18.3036 | = Antoine coefficient | = | 18.3036 | °K |
| 3816.44 | = Antoine coefficient | = | 3816.44 | °K |
| 273.15 | = temperature conversion factor | = | 273.15 | °K |
| 46.13 | = Antoine coefficient | = | 46.13 | °K |
| 25.4 | = conversion factor | = | 25.4 | mm Hg/in. Hg |
| 5/9 | = Fahrenheit to Celsius conversion factor | = | 5/9 | °C/°F |
| 32 | = temperature conversion (°F) | = | 32 | °F |
| $P_v$ | = vapor pressure, actual (in. Hg) | = | 29.25 | 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) | = | 29.25 | in. Hg |
| $P_v$ | = water vapor pressure, actual (in. Hg) | = | 29.25 | in. Hg |

**6.** Moisture measured in sample (% by volume)

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

Where:

| | | | | |
|---|---|---|---|---|
| $V_{mstd}$ | = volume of gas sampled through the dry gas meter at standard conditions (dscf) | = | 79.428 | dscf |
| $V_{wstd}$ | = volume of water collected at standard conditions (scf) | = | 19.60 | scf |
| $B_{wo}$ | = proportion of water measured in the gas stream by volume | = | 0.1979 | |
| | | = | 19.79 | % |

**7.** Saturated moisture content (% by volume)

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

Where:

| | | | | |
|---|---|---|---|---|
| $P_s$ | = absolute sample gas pressure (in. Hg) | = | 29.25 | in. Hg |
| $P_v$ | = water vapor pressure, actual (in. Hg) | = | 29.25 | in. Hg |
| $B_{ws}$ | = proportion of water vapor in the gas stream by volume at saturated conditions | | 1.0000 | |
| | | = | 100.00 | % |







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**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 | = | 0.1979 | |
| $B_w$ | = actual water vapor in gas | = | 0.1979 | |
| | | = | 19.79 | % |

**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 (%) | = | 8.3 | % |
| $O_2$ | = proportion of oxygen in the gas stream by volume (%) | = | 10.7 | % |
| 100 | = conversion factor (%) | = | 100 | % |
| $N_2$+CO | = proportion of nitrogen and CO in the gas stream by volume (%) | = | 81.00 | % |

**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 (%) | = | 8.3 | % |
| $O_2$ | = proportion of oxygen in the gas stream by volume (%) | = | 10.7 | % |
| $N_2$+CO | = proportion of nitrogen and CO in the gas stream by volume (%) | = | 81.0 | % |
| 100 | = conversion factor (%) | = | 100 | % |
| $M_d$ | = dry molecular weight of sample gas (lb/lb·mole) | = | 29.75 | lb/lb·mole |

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $B_w$ | = proportion of water vapor in the gas stream by volume | = | 0.1979 | |
| $M_d$ | = 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) | = | 27.43 | lb/lb·mole |







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**12.** Velocity of sample gas (ft/sec)

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

Where:

| | | | | |
|---|---|---|---|---|
| $K_p$ | = velocity pressure constant | = | 85.49 | |
| $C_p$ | = pitot tube coefficient | = | 0.82 | |
| $M_s$ | = wet molecular weight of sample gas, wet basis (lb/lb·mole) | = | 27.43 | lb/lb·mole |
| $P_s$ | = absolute sample gas pressure (in. Hg) | = | 29.25 | in. Hg |
| $T_s$ | = average sample gas temperature (°F) | = | 305.84 | °F |
| $\sqrt{\Delta P}$ | = average square roots of velocity heads of sample gas (in. $H_2O$) | = | 0.710 | $\sqrt{}$in. $H_2O$ |
| 460 | = °F to °R conversion constant | = | 460 | |
| $V_s$ | = sample gas velocity (ft/sec) | = | 48.61 | 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) | = | 48.61 | ft/sec |
| 60 | conversion factor (sec/min) | = | 60 | sec/min |
| $Q_a$ | = volumetric flow rate at actual conditions (acfm) | = | 186,645 | 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) | = | 186,645 | acfm |
| $P_s$ | = absolute sample gas pressure (in. Hg) | = | 29.25 | in. Hg |
| 29.92 | = standard pressure (in. Hg) | = | 29.92 | in. Hg |
| $T_s$ | = average sample gas temperature (°F) | = | 305.8 | °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) | = | 125,812 | 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 | = | 0.1979 | |
| $Q_s$ | = volumetric flow rate at standard conditions, wet basis (scfm) | = | 125,812 | scfm |
| $Q_{std}$ | = volumetric flow rate at standard conditions, dry basis (dscfm) | = | 100,911 | dscfm |







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**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) | = | 100,911 | dscfm |
| $O_2$ | = proportion of oxygen in the gas stream by volume (%) | = | 10.7 | % |
| 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) | = | 73,808 | 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) | = | 100,911 | dscfm |
| 60 | = conversion factor (min/hr) | = | 60 | min/hr |
| $Q_{std-hr}$ | = volumetric flow rate, hourly basis (dscf/hr) | = | 6,054,636 | 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) | = | 100,911 | 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) | = | 171,471 | 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) | = | 171,471 | 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) | = | 159,780 | dry $Nm^3$/hr |







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**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) | = | 0.271 | in. |
| $B_w$ | = proportion of water vapor in the gas stream by volume | = | 0.1979 | |
| $P_s$ | = absolute sample gas pressure (in. Hg) | = | 29.25 | in. Hg |
| $T_s$ | = average sample gas temperature (°F) | = | 305.8 | °F |
| $V_{mstd}$ | = volume of gas sample through the dry gas meter at standard conditions (dscf) | = | 79.428 | dscf |
| $V_s$ | = sample gas velocity (ft/sec) | = | 48.61 | 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 (%) | = | 100.67 | % |

**21.** Alternative Method 5 Post-Test Meter Calibration Factor

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

Where:

| | | | | |
|---|---|---|---|---|
| θ | = total sampling time (min) | = | 125 | min |
| $V_m$ | = volume of gas sample through the dry gas meter at meter conditions (dcf) | = | 76.69 | dcf |
| $T_m$ | = average dry gas meter temperature (°F) | = | 51.12 | °F |
| $\Delta H_@$ | = dry gas meter orifice coefficient | = | 1.7601 | |
| $P_{bar}$ | = barometric pressure (in. Hg) | = | 30.04 | in. Hg |
| ΔH | = average pressure drop across meter box orifice (in. $H_2O$) | = | 1.223 | in. $H_2O$ |
| $M_d$ | = dry molecular weight of sample gas (lb/lb·mole) | = | 29.75 | lb/lb·mole |
| $\sqrt{\Delta H_{avg}}$ | = average of square root of pressure drop across meter orifice | = | 1.102 | √in. $H_2O$ |
| 0.0319 | = conversion constant | = | 0.0319 | |
| 28.96 | = molecular weight of ambient air (lb/lb-mole) | = | 28.96 | lb/lb-mole |
| 13.6 | = conversion factor (in. $H_2O$/in. Hg) | = | 13.6 | in.$H_2O$/in. Hg |
| 460 | = °F to °R conversion constant | = | 460 | |
| $Y_{qa}$ | = alternative Method 5 post-test meter calibration factor | = | 0.9826 | |







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# LOGIC FOR TREATING DETECTION LIMITS

*(mercury only)*

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

| | CASE 1<br>All 5 fractions are D. | CASE 2<br>1 to 4 fractions are ND | CASE 3<br>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<br>All 5 fractions are D. | CASE 2<br>1 to 4 fractions are ND | CASE 3<br>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<br>All 5 fractions are D.<br>$m_{Total\text{-}B}$ = D | CASE 2<br>1 to 4 sample fractions are ND<br>$m_{Total\text{-}B}$ = D | CASE 3<br>All 5 fractions are ND<br>$m_{Total\text{-}B}$ = D | CASE 4<br>Any type of fractions<br>$m_{Total\text{-}B}$ = 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<br>All 5 fractions are D.<br>$m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow} \geq$ MIN(MDL) | CASE 2<br>1 to 4 sample fractions are ND<br>$m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow} \geq$ MIN(MDL) | CASE 3<br>All 5 fractions are ND<br>$m_{Total\text{-}S}$ and $m_{T\text{-}B\text{-}allow}$ anything | CASE 4<br>Any type of fractions<br>$m_{Total\text{-}S} - m_{T\text{-}B\text{-}allow}$ < 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.

## USEPA Method 29
## Mercury Analyte Calculations

**Sample data taken from Run 1**

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

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

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**1.** Total blank amount (µg)

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

Where:

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

**2.** Total sample amount (µg)

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_{1b-S}$ | = mercury amount in sample for Fraction 1b | = | <0.1000 | µg |
| $m_{2b-S}$ | = mercury amount in sample for Fraction 2b | = | 7.9536 | µg |
| $m_{3a-S}$ | = mercury amount in sample for Fraction 3a | = | <0.2000 | µg |
| $m_{3b-S}$ | = mercury amount in sample for Fraction 3b | = | <0.5000 | µg |
| $m_{3c-S}$ | = mercury amount in sample for Fraction 3c | = | <0.4000 | µg |
| $m_{total-S}$ | = total amount of mercury in sample | = | 7.9536 | µg |

**3.** Allowable blank correction (µg)

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_{total-B}$ | = total amount of mercury in blank | = | <1.4000 | µg |
| $m_{total-S}$ | = total amount of mercury in sample | = | 7.9536 | µg |
| 0.05 x $m_{total-S}$ | = 5% of $m_{total-S}$ | = | 0.3977 | µg |
| MAX | = arithmetic operator that returns the maximum of two values | | | |
| MIN | = arithmetic operator that returns the minimum of two values | | | |
| $m_{T-B-allow}$ | = total allowable blank correction | = | 0.0000 | µg |

*NOTE: In this case, the second criteria applies.*





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**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 | = | 7.9536 | µg |
| $m_{T-B-allow}$ | = total allowable blank correction | = | 0.0000 | µg |
| $m_n$ | = total mercury in sample corrected for allowable blank | = | 7.9536 | µg |

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_n$ | = total mercury in sample corrected for allowable blank | = | 7.9536 | µg |
| $m_{1b-S}$ | = mercury amount in sample for Fraction 1b | = | <0.1000 | µg |
| $m_{2b-S}$ | = mercury amount in sample for Fraction 2b | = | 7.9536 | µg |
| $m_{3a-S}$ | = mercury amount in sample for Fraction 3a | = | <0.2000 | µg |
| $m_{3b-S}$ | = mercury amount in sample for Fraction 3b | = | <0.5000 | µg |
| $m_{3c-S}$ | = mercury amount in sample for Fraction 3c | = | <0.4000 | µg |
| $m_{total-S}$ | = total amount of mercury in sample | = | 7.9536 | µg |
| $m_{n-1b}$ | = mercury corrected for blank - prorated for Fraction 1b | = | <0.1000 | µg |
| $m_{n-2b}$ | = mercury corrected for blank - prorated for Fraction 2b | = | 7.9536 | µg |
| $m_{n-3a}$ | = mercury corrected for blank - prorated for Fraction 3a | = | <0.2000 | µg |
| $m_{n-3b}$ | = mercury corrected for blank - prorated for Fraction 3b | = | <0.5000 | µg |
| $m_{n-3c}$ | = mercury corrected for blank - prorated for Fraction 3c | = | <0.4000 | µg |





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## USEPA Method 29
## Mercury Sample Calculations

**Sample data taken from Run 1**

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

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**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) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| $2.205 \times 10^{-3}$ | = 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) | = | 2.2080E-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) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| 35.31 | = conversion factor (dscf/dscm) | = | 35.31 | dscf/dscm |
| $C_{sd}$ | = mercury concentration (µg/dscm) | = | 3.5358E+00 | µg/dscm |

**3.** Mercury concentration (mg/dscm)

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_n$ | = mercury collected in sample (total µg) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | 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) | = | 3.5358E-03 | mg/dscm |





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**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) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | 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) | = | 3.7945E+00 | µg/Nm$^3$ dry |

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $C_{sd}$ | = mercury concentration (lb/dscf) | = | 2.2080E-10 | lb/dscf |
| x | = oxygen content of corrected gas (%) | = | 7.0 | % |
| $O_2$ | = proportion of oxygen in the gas stream by volume (%) | = | 10.7 | % |
| 20.9 | = oxygen content of ambient air (%) | = | 20.9 | % |
| $C_{sdx}$ | = mercury concentration corrected to x% oxygen (lb/dscf) | = | 3.0188E-10 | lb/dscf @ x%$O_2$ |

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $C_{sd}$ | = mercury concentration (lb/dscf) | = | 2.2080E-10 | lb/dscf |
| y | = carbon dioxide content of corrected gas (%) | = | 12.0 | % |
| $CO_2$ | = proportion of carbon dioxide in the gas stream by volume (%) | = | 8.3 | % |
| $C_{sdy}$ | = mercury conc. corrected to y% carbon dioxide (lb/dscf) | = | 3.2052E-10 | lb/dscf @ y%$CO_2$ |

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $C_{sd}$ | = mercury concentration (lb/dscf) | = | 2.2080E-10 | lb/dscf |
| $Q_{std}$ | = volumetric flow rate at standard conditions, dry basis (dscfm) | = | 100,911 | dscfm |
| $Q_a$ | = volumetric flow rate at actual conditions (acfm) | = | 186,645 | acfm |
| $C_a$ | = mercury concentration at actual gas conditions (lb/acf) | = | 1.1938E-10 | lb/acf |





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**8.** Mercury emission rate (lb/hr)

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_n$ | = mercury collected in sample (total µg) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| $2.205 \times 10^{-3}$ | = 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) | = | 100,911 | dscfm |
| 60 | = conversion factor (min/hr) | = | 60 | min/hr |
| $E_{lb/hr}$ | = mercury emission rate (lb/hr) | = | 1.3369E-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) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| $Q_{std}$ | = volumetric flow rate at standard conditions, dry basis (dscfm) | = | 100,911 | 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) | = | 1.6841E-04 | g/s |

**10.** Mercury emission rate (Ton/yr)

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_n$ | = mercury collected in sample (total µg) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| $2.205 \times 10^{-3}$ | = 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) | = | 100,911 | 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) | = | 5.8555E-03 | Ton/yr |





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**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) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| $2.205 \times 10^{-3}$ | = 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 (%) | = | 10.7 | % |
| 20.9 | = oxygen content of ambient air (%) | = | 20.9 | % |
| $E_{Fd}$ | = mercury emission rate - Fd-based (lb/MMBtu) | = | 4.3439E-06 | lb/MMBtu |

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

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

Where:

| | | | | |
|---|---|---|---|---|
| $m_n$ | = mercury collected in sample (total µg) | = | 7.9536 | µg |
| $V_{mstd}$ | = volume metered, standard (dscf) | = | 79.4277 | dscf |
| $2.205 \times 10^{-3}$ | = 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 (%) | = | 8.3 | % |
| 100 | = conversion factor | = | 100 | |
| $E_{Fc}$ | = mercury emission rate - Fc-based (lb/MMBtu) | = | 4.8612E-06 | lb/MMBtu |





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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 3 FF Outlet

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

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Sampling Conditions** | | | | | |
| $Y_d$ | Dry gas meter correction factor | 0.9960 | 0.9960 | 0.9960 | |
| $C_p$ | Pitot tube coefficient | 0.8200 | 0.8200 | 0.8200 | |
| $P_g$ | Static pressure (in. $H_2O$) | -10.7000 | -10.6000 | -10.4000 | |
| $A_n$ | Sample location area ($ft^2$) | 64.0000 | 64.0000 | 64.0000 | |
| $P_{bar}$ | Barometric pressure (in. Hg) | 30.04 | 30.04 | 30.04 | **30.0400** |
| $D_n$ | Nozzle diameter (in.) | 0.2710 | 0.2710 | 0.2710 | |
| $O_2$ | Oxygen (dry volume %) | 10.7333 | 10.7333 | 10.1333 | **10.5333** |
| $CO_2$ | Carbon dioxide (dry volume %) | 8.2667 | 8.2000 | 8.9333 | **8.4667** |
| $N_2$+CO | Nitrogen plus carbon monoxide (dry volume %) | 81.0000 | 81.0667 | 80.9333 | **81.0000** |
| $V_{lc}$ | Total Liquid collected (ml) | 416.50 | 395.10 | 392.00 | |
| $V_m$ | Volume metered, meter conditions ($ft^3$) | 76.6900 | 78.6200 | 77.7450 | |
| $T_m$ | Dry gas meter temperature (°F) | 51.1200 | 63.8000 | 78.4400 | |
| $T_s$ | Sample temperature (°F) | 305.8400 | 306.8400 | 309.0000 | **307.2267** |
| $\Delta H$ | Meter box orifice pressure drop (in. $H_2O$) | 1.2232 | 1.2308 | 1.1676 | |
| $\theta$ | Total sampling time (min) | 125.0 | 125.0 | 125.0 | |
| **Flow Results** | | | | | |
| $V_{wstd}$ | Volume of water collected ($ft^3$) | 19.6005 | 18.5934 | 18.4475 | **18.8805** |
| $V_{mstd}$ | Volume metered, standard (dscf) | 79.4277 | 79.4569 | 76.4245 | **78.4364** |
| $P_s$ | Sample gas pressure, absolute (in. Hg) | 29.2532 | 29.2606 | 29.2753 | **29.2630** |
| $P_v$ | Vapor pressure, actual (in. Hg) | 29.2532 | 29.2606 | 29.2753 | **29.2630** |
| $B_{wo}$ | Moisture measured in sample (% by volume) | 19.7928 | 18.9631 | 19.4446 | **19.4002** |
| $B_{ws}$ | Saturated moisture content (% by volume) | 100.0000 | 100.0000 | 100.0000 | **100.0000** |
| $B_w$ | Actual water vapor in gas (% by volume) | 19.7928 | 18.9631 | 19.4446 | **19.4002** |
| $\sqrt{\Delta P}$ | Velocity head ($\sqrt{}$in. $H_2O$) | 0.7097 | 0.7122 | 0.6895 | **0.7038** |
| $M_d$ | MW of sample gas, dry (lb/lb-mole) | 29.7520 | 29.7413 | 29.8347 | **29.7760** |
| $M_s$ | MW of sample gas, wet (lb/lb-mole) | 27.4259 | 27.5148 | 27.5335 | **27.4914** |
| $V_s$ | Velocity of sample (ft/sec) | 48.6054 | 48.7267 | 47.2119 | **48.1813** |
| %I | Isokinetic sampling (%) | 100.6687 | 99.5313 | 99.6247 | **99.9416** |
| $Q_a$ | Volumetric flow rate, actual (acfm) | 186,645 | 187,110 | 181,294 | **185,016** |
| $Q_s$ | Volumetric flow rate, standard (scfm) | 125,812 | 125,994 | 121,795 | **124,534** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dscfm) | 100,911 | 102,101 | 98,113 | **100,375** |
| $Q_{std7}$ | Volumetric flow rate, dry std@7%$O_2$ (dscfm) | 73,808 | 74,678 | 75,996 | **74,827** |
| $Q_a$ | Volumetric flow rate, actual (acf/hr) | 11,198,676 | 11,226,627 | 10,877,631 | **11,100,978** |
| $Q_s$ | Volumetric flow rate, standard (scf/hr) | 7,548,747 | 7,559,619 | 7,307,715 | **7,472,027** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dscf/hr) | 6,054,636 | 6,126,080 | 5,886,756 | **6,022,490** |
| $Q_a$ | Volumetric flow rate, actual ($m^3$/hr) | 317,153 | 317,945 | 308,061 | **314,386** |
| $Q_s$ | Volumetric flow rate, standard ($m^3$/hr) | 213,785 | 214,093 | 206,959 | **211,612** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dry $m^3$/hr) | 171,471 | 173,494 | 166,716 | **170,560** |
| $Q_{std7}$ | Volumetric flow rate, dry std@7%$O_2$ (dry $m^3$/hr) | 125,416 | 126,896 | 129,135 | **127,149** |
| $Q_s$ | Volumetric flow rate, normal ($Nm^3$/hr) | 199,209 | 199,496 | 192,848 | **197,184** |
| $Q_{std}$ | Volumetric flow rate, dry normal ($Nm^3$/hr) | 159,780 | 161,665 | 155,349 | **158,931** |
| $Q_{std7}$ | Volumetric flow rate, dry normal @7%$O_2$ ($Nm^3$/hr) | 116,865 | 118,244 | 120,331 | **118,480** |

Comments:
Average includes 3 runs.

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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 3 FF Outlet

## USEPA Method 29
## Mercury (Hg) Emission Parameters

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Process Conditions** | | | | | |
| $R_P$ | Steam Production Rate - (Klbs/hour) | 179.6 | 179.9 | 180.0 | **179.9** |
| $P_1$ | SDA Outlet Temperature - (°F) | 320 | 320 | 320 | **320** |
| $F_d$ | 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 %) | 10.7333 | 10.7333 | 10.1333 | **10.5333** |
| $CO_2$ | Carbon dioxide (dry volume %) | 8.2667 | 8.2000 | 8.9333 | **8.4667** |
| $T_s$ | Sample temperature (°F) | 305.8400 | 306.8400 | 309.0000 | **307.2267** |
| $B_w$ | Actual water vapor in gas (% by volume) | 19.7928 | 18.9631 | 19.4446 | **19.4002** |
| **Gas Flow Rate** | | | | | |
| $Q_a$ | Volumetric flow rate, actual (acfm) | 186,645 | 187,110 | 181,294 | **185,016** |
| $Q_s$ | Volumetric flow rate, standard (scfm) | 125,812 | 125,994 | 121,795 | **124,534** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dscfm) | 100,911 | 102,101 | 98,113 | **100,375** |
| $Q_{std7}$ | Volumetric flow rate, dry std@7%$O_2$ (dscfm) | 73,808 | 74,678 | 75,996 | **74,827** |
| $Q_a$ | Volumetric flow rate, actual (acf/hr) | 11,198,676 | 11,226,627 | 10,877,631 | **11,100,978** |
| $Q_s$ | Volumetric flow rate, standard (scf/hr) | 7,548,747 | 7,559,619 | 7,307,715 | **7,472,027** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dscf/hr) | 6,054,636 | 6,126,080 | 5,886,756 | **6,022,490** |
| $Q_a$ | Volumetric flow rate, actual ($m^3$/hr) | 317,153 | 317,945 | 308,061 | **314,386** |
| $Q_s$ | Volumetric flow rate, standard ($m^3$/hr) | 213,785 | 214,093 | 206,959 | **211,612** |
| $Q_{std}$ | Volumetric flow rate, dry standard (dry $m^3$/hr) | 171,471 | 173,494 | 166,716 | **170,560** |
| $Q_{std7}$ | Volumetric flow rate, dry std@7%$O_2$ (dry $m^3$/hr) | 125,416 | 126,896 | 129,135 | **127,149** |
| $Q_s$ | Volumetric flow rate, normal ($Nm^3$/hr) | 199,209 | 199,496 | 192,848 | **197,184** |
| $Q_{std}$ | Volumetric flow rate, dry normal ($Nm^3$/hr) | 159,780 | 161,665 | 155,349 | **158,931** |
| $Q_{std7}$ | Volumetric flow rate, dry normal @7%$O_2$ ($Nm^3$/hr) | 116,865 | 118,244 | 120,331 | **118,480** |
| **Sampling Data** | | | | | |
| $V_{mstd}$ | Volume metered, standard (dscf) | 79.4277 | 79.4569 | 76.4245 | **78.4364** |
| %I | Isokinetic sampling (%) | 100.6687 | 99.5313 | 99.6247 | **99.9416** |
| **Laboratory Data** | | | | | |
| $m_{n-1b}$ | Fraction 1B Prorated (µg) | <0.1000 | <0.1000 | <0.1000 | **<0.1000** |
| $m_{n-2b}$ | Fraction 2B Prorated (µg) | 7.9536 | 7.4497 | 10.7533 | **8.7189** |
| $m_{n-3a}$ | Fraction 3A Prorated (µg) | <0.2000 | 0.3763 | <0.2000 | **<0.2588** |
| $m_{n-3b}$ | Fraction 3B Prorated (µg) | <0.5000 | <0.5000 | <0.5000 | **<0.5000** |
| $m_{n-3c}$ | Fraction 3C Prorated (µg) | <0.4000 | <0.4000 | <0.4000 | **<0.4000** |
| $m_n$ | Total matter corrected for allowable blanks (µg) | 7.9536 | 7.8260 | 10.7533 | **8.8443** |
| **Mercury Results - Total** | | | | | |
| $C_{ad}$ | Concentration (lb/dscf) | 2.2080E-10 | 2.1718E-10 | 3.1026E-10 | **2.4941E-10** |
| $C_{ad7}$ | Concentration @7% $O_2$ (lb/dscf) | 3.0188E-10 | 2.9693E-10 | 4.0055E-10 | **3.3312E-10** |
| $C_{ad12}$ | Concentration @12% $CO_2$ (lb/dscf) | 3.2052E-10 | 3.1782E-10 | 4.1676E-10 | **3.5170E-10** |
| $C_a$ | Concentration (lb/acf) | 1.1938E-10 | 1.1851E-10 | 1.6790E-10 | **1.3526E-10** |
| $C_{ad}$ | Concentration (µg/dscm) | 3.5358E+00 | 3.4778E+00 | 4.9683E+00 | **3.9940E+00** |
| $C_{ad7}$ | Concentration @7% $O_2$ (µg/dscm) | 4.8342E+00 | 4.7549E+00 | 6.4142E+00 | **5.3344E+00** |
| $C_{ad12}$ | Concentration @12% $CO_2$ (µg/dscm) | 5.1326E+00 | 5.0895E+00 | 6.6738E+00 | **5.6320E+00** |
| $C_{ad}$ | Concentration (mg/dscm) | 3.5358E-03 | 3.4778E-03 | 4.9683E-03 | **3.9940E-03** |
| $C_{ad7}$ | Concentration @7% $O_2$ (mg/dscm) | 4.8342E-03 | 4.7549E-03 | 6.4142E-03 | **5.3344E-03** |
| $C_{ad12}$ | Concentration @12% $CO_2$ (mg/dscm) | 5.1326E-03 | 5.0895E-03 | 6.6738E-03 | **5.6320E-03** |
| $C_a$ | Concentration (µg/$m^3$ (actual,wet)) | 1.9117E+00 | 1.8978E+00 | 2.6887E+00 | **2.1661E+00** |
| $C_{ad}$ | Concentration (µg/$Nm^3$ dry) | 3.7945E+00 | 3.7323E+00 | 5.3318E+00 | **4.2862E+00** |
| $C_{ad7}$ | Concentration @7% $O_2$ (µg/$Nm^3$ dry) | 5.1879E+00 | 5.1028E+00 | 6.8835E+00 | **5.7248E+00** |
| $C_{ad12}$ | Concentration @12% $CO_2$ (µg/$Nm^3$ dry) | 5.5082E+00 | 5.4619E+00 | 7.1622E+00 | **6.0441E+00** |
| $E_{lb/hr}$ | Rate (lb/hr) | 1.3369E-03 | 1.3305E-03 | 1.8264E-03 | **1.4979E-03** |
| $E_{g/s}$ | Rate (g/s) | 1.6841E-04 | 1.6761E-04 | 2.3008E-04 | **1.8870E-04** |
| $E_{T/yr}$ | Rate (Ton/yr) | 5.8555E-03 | 5.8274E-03 | 7.9996E-03 | **6.5608E-03** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | 4.3439E-06 | 4.2726E-06 | 5.7636E-06 | **4.7934E-06** |
| $E_{Fc}$ | Rate - Fc-based (lb/MMBtu) | 4.8612E-06 | 4.8203E-06 | 6.3209E-06 | **5.3341E-06** |

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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 3 FF Outlet

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

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Mercury Results - Front Half** | | | | | |
| $C_{sd}$ | Concentration (lb/dscf) | <2.7761E-12 | <2.7751E-12 | <2.8852E-12 | **<2.8121E-12** |
| $C_{sd7}$ | Concentration @7% $O_2$ (lb/dscf) | <3.7955E-12 | <3.7941E-12 | <3.7249E-12 | **<3.7715E-12** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (lb/dscf) | <4.0298E-12 | <4.0611E-12 | <3.8756E-12 | **<3.9889E-12** |
| $C_a$ | Concentration (lb/acf) | <1.5009E-12 | <1.5143E-12 | <1.5614E-12 | **<1.5255E-12** |
| $C_{sd}$ | Concentration (µg/dscm) | <4.4456E-02 | <4.4439E-02 | <4.6202E-02 | **<4.5032E-02** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/dscm) | <6.0780E-02 | <6.0758E-02 | <5.9648E-02 | **<6.0395E-02** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/dscm) | <6.4532E-02 | <6.5033E-02 | <6.2063E-02 | **<6.3876E-02** |
| $C_{sd}$ | Concentration (mg/dscm) | <4.4456E-05 | <4.4439E-05 | <4.6202E-05 | **<4.5032E-05** |
| $C_{sd7}$ | Concentration @7% $O_2$ (mg/dscm) | <6.0780E-05 | <6.0758E-05 | <5.9648E-05 | **<6.0395E-05** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (mg/dscm) | <6.4532E-05 | <6.5033E-05 | <6.2063E-05 | **<6.3876E-05** |
| $C_a$ | Concentration (µg/$m^3$ (actual,wet)) | <2.4035E-02 | <2.4249E-02 | <2.5004E-02 | **<2.4429E-02** |
| $C_{sd}$ | Concentration (µg/$Nm^3$ dry) | <4.7708E-02 | <4.7691E-02 | <4.9583E-02 | **<4.8327E-02** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/$Nm^3$ dry) | <6.5227E-02 | <6.5204E-02 | <6.4013E-02 | **<6.4815E-02** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/$Nm^3$ dry) | <6.9254E-02 | <6.9791E-02 | <6.6604E-02 | **<6.8550E-02** |
| $E_{lb/hr}$ | Rate (lb/hr) | <1.6808E-05 | <1.7000E-05 | <1.6984E-05 | **<1.6931E-05** |
| $E_{g/s}$ | Rate (g/s) | <2.1175E-06 | <2.1416E-06 | <2.1396E-06 | **<2.1329E-06** |
| $E_{T/yr}$ | Rate (Ton/yr) | <7.3620E-05 | <7.4462E-05 | <7.4392E-05 | **<7.4158E-05** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | <5.4616E-08 | <5.4595E-08 | <5.3599E-08 | **<5.4270E-08** |
| $E_{Fc}$ | Rate - Fc-based (lb/MMBtu) | <6.1119E-08 | <6.1593E-08 | <5.8781E-08 | **<6.0498E-08** |

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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 3 FF Outlet

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

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Mercury Results - Impingers 1-3 Solution** | | | | | |
| $C_{sd}$ | Concentration (lb/dscf) | 2.2080E-10 | 2.0674E-10 | 3.1026E-10 | **2.4593E-10** |
| $C_{sd7}$ | Concentration @7% $O_2$ (lb/dscf) | 3.0188E-10 | 2.8265E-10 | 4.0055E-10 | **3.2836E-10** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (lb/dscf) | 3.2052E-10 | 3.0254E-10 | 4.1676E-10 | **3.4661E-10** |
| $C_a$ | Concentration (lb/acf) | 1.1938E-10 | 1.1281E-10 | 1.6790E-10 | **1.3336E-10** |
| $C_{sd}$ | Concentration (µg/dscm) | 3.5358E+00 | 3.3106E+00 | 4.9683E+00 | **3.9382E+00** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/dscm) | 4.8342E+00 | 4.5263E+00 | 6.4142E+00 | **5.2582E+00** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/dscm) | 5.1326E+00 | 4.8447E+00 | 6.6738E+00 | **5.5504E+00** |
| $C_{sd}$ | Concentration (mg/dscm) | 3.5358E-03 | 3.3106E-03 | 4.9683E-03 | **3.9382E-03** |
| $C_{sd7}$ | Concentration @7% $O_2$ (mg/dscm) | 4.8342E-03 | 4.5263E-03 | 6.4142E-03 | **5.2582E-03** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (mg/dscm) | 5.1326E-03 | 4.8447E-03 | 6.6738E-03 | **5.5504E-03** |
| $C_a$ | Concentration (µg/m$^3$ (actual,wet)) | 1.9117E+00 | 1.8065E+00 | 2.6887E+00 | **2.1356E+00** |
| $C_{sd}$ | Concentration (µg/Nm$^3$ dry) | 3.7945E+00 | 3.5528E+00 | 5.3318E+00 | **4.2264E+00** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/Nm$^3$ dry) | 5.1879E+00 | 4.8575E+00 | 6.8835E+00 | **5.6430E+00** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/Nm$^3$ dry) | 5.5082E+00 | 5.1992E+00 | 7.1622E+00 | **5.9565E+00** |
| $E_{lb/hr}$ | Rate (lb/hr) | 1.3369E-03 | 1.2665E-03 | 1.8264E-03 | **1.4766E-03** |
| $E_{g/s}$ | Rate (g/s) | 1.6841E-04 | 1.5955E-04 | 2.3008E-04 | **1.8601E-04** |
| $E_{T/yr}$ | Rate (Ton/yr) | 5.8555E-03 | 5.5472E-03 | 7.9996E-03 | **6.4674E-03** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | 4.3439E-06 | 4.0672E-06 | 5.7636E-06 | **4.7249E-06** |
| $E_{Fc}$ | Rate - Fc-based (lb/MMBtu) | 4.8612E-06 | 4.5885E-06 | 6.3209E-06 | **5.2569E-06** |

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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 3 FF Outlet

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

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Mercury Results - Impinger 4 Solution** | | | | | |
| $C_{sd}$ | Concentration (lb/dscf) | <5.5522E-12 | 1.0443E-11 | <5.7704E-12 | **<7.2554E-12** |
| $C_{sd7}$ | Concentration @7% $O_2$ (lb/dscf) | <7.5911E-12 | 1.4278E-11 | <7.4497E-12 | **<9.7731E-12** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (lb/dscf) | <8.0597E-12 | 1.5283E-11 | <7.7513E-12 | **<1.0365E-11** |
| $C_a$ | Concentration (lb/acf) | <3.0018E-12 | 5.6987E-12 | <3.1228E-12 | **<3.9411E-12** |
| $C_{sd}$ | Concentration (µg/dscm) | <8.8911E-02 | 1.6724E-01 | <9.2405E-02 | **<1.1618E-01** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/dscm) | <1.2156E-01 | 2.2865E-01 | <1.1930E-01 | **<1.5650E-01** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/dscm) | <1.2906E-01 | 2.4474E-01 | <1.2413E-01 | **<1.6598E-01** |
| $C_{sd}$ | Concentration (mg/dscm) | <8.8911E-05 | 1.6724E-04 | <9.2405E-05 | **<1.1618E-04** |
| $C_{sd7}$ | Concentration @7% $O_2$ (mg/dscm) | <1.2156E-04 | 2.2865E-04 | <1.1930E-04 | **<1.5650E-04** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (mg/dscm) | <1.2906E-04 | 2.4474E-04 | <1.2413E-04 | **<1.6598E-04** |
| $C_a$ | Concentration (µg/m$^3$ (actual,wet)) | <4.8070E-02 | 9.1257E-02 | <5.0008E-02 | **<6.3112E-02** |
| $C_{sd}$ | Concentration (µg/Nm$^3$ dry) | <9.5417E-02 | 1.7947E-01 | <9.9166E-02 | **<1.2469E-01** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/Nm$^3$ dry) | <1.3045E-01 | 2.4538E-01 | <1.2803E-01 | **<1.6795E-01** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/Nm$^3$ dry) | <1.3851E-01 | 2.6265E-01 | <1.3321E-01 | **<1.7812E-01** |
| $E_{lb/hr}$ | Rate (lb/hr) | <3.3617E-05 | 6.3978E-05 | <3.3969E-05 | **<4.3854E-05** |
| $E_{g/s}$ | Rate (g/s) | <4.2349E-06 | 8.0597E-06 | <4.2793E-06 | **<5.5246E-06** |
| $E_{T/yr}$ | Rate (Ton/yr) | <1.4724E-04 | 2.8022E-04 | <1.4878E-04 | **<1.9208E-04** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | <1.0923E-07 | 2.0546E-07 | <1.0720E-07 | **<1.4063E-07** |
| $E_{Fc}$ | Rate - Fc-based (lb/MMBtu) | <1.2224E-07 | 2.3179E-07 | <1.1756E-07 | **<1.5720E-07** |

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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 3 FF Outlet

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

| Run No. | | 1 | 2 | 3 | Average |
|---|---|---|---|---|---|
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 | |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 | |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 | |
| **Mercury Results - Filtered Permanganate Solution** | | | | | |
| $C_{sd}$ | Concentration (lb/dscf) | <1.3881E-11 | <1.3875E-11 | <1.4426E-11 | **<1.4061E-11** |
| $C_{sd7}$ | Concentration @7% $O_2$ (lb/dscf) | <1.8978E-11 | <1.8971E-11 | <1.8624E-11 | **<1.8858E-11** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (lb/dscf) | <2.0149E-11 | <2.0306E-11 | <1.9378E-11 | **<1.9944E-11** |
| $C_a$ | Concentration (lb/acf) | <7.5046E-12 | <7.5715E-12 | <7.8071E-12 | **<7.6277E-12** |
| $C_{sd}$ | Concentration (µg/dscm) | <2.2228E-01 | <2.2220E-01 | <2.3101E-01 | **<2.2516E-01** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/dscm) | <3.0390E-01 | <3.0379E-01 | <2.9824E-01 | **<3.0198E-01** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/dscm) | <3.2266E-01 | <3.2516E-01 | <3.1032E-01 | **<3.1938E-01** |
| $C_{sd}$ | Concentration (mg/dscm) | <2.2228E-04 | <2.2220E-04 | <2.3101E-04 | **<2.2516E-04** |
| $C_{sd7}$ | Concentration @7% $O_2$ (mg/dscm) | <3.0390E-04 | <3.0379E-04 | <2.9824E-04 | **<3.0198E-04** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (mg/dscm) | <3.2266E-04 | <3.2516E-04 | <3.1032E-04 | **<3.1938E-04** |
| $C_a$ | Concentration (µg/m$^3$ (actual,wet)) | <1.2018E-01 | <1.2125E-01 | <1.2502E-01 | **<1.2215E-01** |
| $C_{sd}$ | Concentration (µg/Nm$^3$ dry) | <2.3854E-01 | <2.3845E-01 | <2.4792E-01 | **<2.4164E-01** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/Nm$^3$ dry) | <3.2614E-01 | <3.2602E-01 | <3.2006E-01 | **<3.2407E-01** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/Nm$^3$ dry) | <3.4627E-01 | <3.4896E-01 | <3.3302E-01 | **<3.4275E-01** |
| $E_{lb/hr}$ | Rate (lb/hr) | <8.4042E-05 | <8.5002E-05 | <8.4922E-05 | **<8.4655E-05** |
| $E_{g/s}$ | Rate (g/s) | <1.0587E-05 | <1.0708E-05 | <1.0698E-05 | **<1.0665E-05** |
| $E_{T/yr}$ | Rate (Ton/yr) | <3.6810E-04 | <3.7231E-04 | <3.7196E-04 | **<3.7079E-04** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | <2.7308E-07 | <2.7298E-07 | <2.6799E-07 | **<2.7135E-07** |
| $E_{Fc}$ | Rate - Fc-based (lb/MMBtu) | <3.0560E-07 | <3.0797E-07 | <2.9390E-07 | **<3.0249E-07** |
| **Mercury Results - HCl Rinse + HCl/MnO2 Precipitate** | | | | | |
| $C_{sd}$ | Concentration (lb/dscf) | <1.1104E-11 | <1.1100E-11 | <1.1541E-11 | **<1.1249E-11** |
| $C_{sd7}$ | Concentration @7% $O_2$ (lb/dscf) | <1.5182E-11 | <1.5177E-11 | <1.4899E-11 | **<1.5086E-11** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (lb/dscf) | <1.6119E-11 | <1.6244E-11 | <1.5503E-11 | **<1.5955E-11** |
| $C_a$ | Concentration (lb/acf) | <6.0037E-12 | <6.0572E-12 | <6.2457E-12 | **<6.1022E-12** |
| $C_{sd}$ | Concentration (µg/dscm) | <1.7782E-01 | <1.7776E-01 | <1.8481E-01 | **<1.8013E-01** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/dscm) | <2.4312E-01 | <2.4303E-01 | <2.3859E-01 | **<2.4158E-01** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/dscm) | <2.5813E-01 | <2.6013E-01 | <2.4825E-01 | **<2.5550E-01** |
| $C_{sd}$ | Concentration (mg/dscm) | <1.7782E-04 | <1.7776E-04 | <1.8481E-04 | **<1.8013E-04** |
| $C_{sd7}$ | Concentration @7% $O_2$ (mg/dscm) | <2.4312E-04 | <2.4303E-04 | <2.3859E-04 | **<2.4158E-04** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (mg/dscm) | <2.5813E-04 | <2.6013E-04 | <2.4825E-04 | **<2.5550E-04** |
| $C_a$ | Concentration (µg/m$^3$ (actual,wet)) | <9.6141E-02 | <9.6997E-02 | <1.0002E-01 | **<9.7718E-02** |
| $C_{sd}$ | Concentration (µg/Nm$^3$ dry) | <1.9083E-01 | <1.9076E-01 | <1.9833E-01 | **<1.9331E-01** |
| $C_{sd7}$ | Concentration @7% $O_2$ (µg/Nm$^3$ dry) | <2.6091E-01 | <2.6081E-01 | <2.5605E-01 | **<2.5926E-01** |
| $C_{sd12}$ | Concentration @12% $CO_2$ (µg/Nm$^3$ dry) | <2.7702E-01 | <2.7917E-01 | <2.6642E-01 | **<2.7420E-01** |
| $E_{lb/hr}$ | Rate (lb/hr) | <6.7233E-05 | <6.8002E-05 | <6.7938E-05 | **<6.7724E-05** |
| $E_{g/s}$ | Rate (g/s) | <8.4698E-06 | <8.5666E-06 | <8.5586E-06 | **<8.5317E-06** |
| $E_{T/yr}$ | Rate (Ton/yr) | <2.9448E-04 | <2.9785E-04 | <2.9757E-04 | **<2.9663E-04** |
| $E_{Fd}$ | Rate - Fd-based (lb/MMBtu) | <2.1846E-07 | <2.1838E-07 | <2.1439E-07 | **<2.1708E-07** |
| $E_{Fc}$ | Rate - Fc-based (lb/MMBtu) | <2.4448E-07 | <2.4637E-07 | <2.3512E-07 | **<2.4199E-07** |

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## QA/QC DATA

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# Nozzle Calibration Sheet

| | |
|---|---|
| Client Wheelabrator | Project Number 10955 |
| Calibrated by C. Slimp | Unit 3 |
| Date 12/7/10 | Runs 1 |

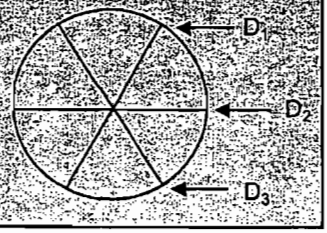
| Nozzle Identification | $D_1$ (inches) | $D_2$ (inches) | $D_3$ (inches) | $\Delta D$ (inches) | $D_{ave}$ (inches) |
|---|---|---|---|---|---|
| 271-1 | 0.272 | 0.271 | 0.271 | 0.001 | 0.271 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

$D_1, D_2, D_3$ = three nozzle diameter measurements

$\Delta D$ = maximum difference between any two diameters

$\Delta D = 0.004$ inches*

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




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

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Date 12/8/10

CleanAir ENGINEERING

# Meter Box Full Test Calibration

**Meter Box No:** 61-6

**Date of Calibration:** 7/20/2010

**Meter Box $Y_d$:** 0.9960

**Calibration Conducted by:** Martin Vaquero

**Meter Box ΔH@:** 1.7601

**Signature:** Martin Vaquero

**Barometric Pressure:** 29.23

| | | | | Standard Meter Gas Volume ($ft^3$) | | | Meter Box Gas Volume ($ft^3$) | | | Std. Meter Temperature (°F) | | | Meter Box Temperature (°F) | | | Time (min.) | Calibration Results | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q | ΔH | ΔP | $Y_{ds}$ | Initial | Final | $V_{ds}$ Net | Initial | Final | $V_d$ Net | $T_{is}$ In | $T_{os}$ Out | $T_{ds}$ Avg. | $T_i$ In | $T_o$ Out | $T_d$ Avg. | Θ | $Y_d$ | ΔH@ |
| 0.967 | 3.00 | -1.90 | 1.0000 | 0.000 | 10.000 | 10.000 | 821.383 | 831.452 | 10.069 | 77.0 | 77.0 | 77.00 | 91.0 | 81.0 | 86.00 | 9.93 | 0.9974 | 1.7208 |
| 0.965 | 3.00 | -1.90 | 1.0000 | 0.000 | 10.000 | 10.000 | 831.452 | 841.541 | 10.089 | 77.0 | 77.0 | 77.00 | 91.0 | 81.0 | 86.00 | 9.95 | 0.9955 | 1.7277 |
| 0.385 | 0.50 | -1.10 | 1.0000 | 0.000 | 5.000 | 5.000 | 851.319 | 856.360 | 5.041 | 77.0 | 77.0 | 77.00 | 82.0 | 79.0 | 80.50 | 12.48 | 0.9943 | 1.8188 |
| 0.385 | 0.50 | -1.10 | 1.0000 | 0.000 | 5.000 | 5.000 | 856.360 | 861.399 | 5.039 | 77.0 | 77.0 | 77.00 | 82.0 | 79.0 | 80.50 | 12.48 | 0.9947 | 1.8188 |
| 0.681 | 1.50 | -1.40 | 1.0000 | 0.000 | 10.000 | 10.000 | 865.118 | 875.175 | 10.057 | 77.0 | 77.0 | 77.00 | 86.0 | 79.0 | 82.50 | 14.09 | 0.9972 | 1.7387 |
| 0.681 | 1.50 | -1.40 | 1.0000 | 0.000 | 10.000 | 10.000 | 875.175 | 885.256 | 10.081 | 77.0 | 77.0 | 77.00 | 87.0 | 80.0 | 83.50 | 14.09 | 0.9967 | 1.7355 |
| | | | | | | | | | | | | | | | | Averages | 0.99597 | 1.76006 |

## Nomenclature

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

## Equations

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

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

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

Vacuum Gauge

| Standard (in.Hg) | Gauge (in.Hg) |
|---|---|
| 5.5 | 5.0 |
| 10.8 | 10.0 |
| 15.6 | 15.0 |
| 20.5 | 20.0 |
| 24.0 | 24.0 |
| | |
| | |
| | |





CleanAir ENGINEERING

# Meter Box - Pyrometer Calibration Sheet

Meter Box No: 61-6 Office: _____

Calibrated by: Martin Vaquero Client: _____

Date: 7/20/10 Job No: _____

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

| Calibration Reference Settings (°F) | Pyrometer Reading for each Channel (°F) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 Stack | 2 Probe | 3 Filter | 4 Imp Out | 5 Aux | 6 DGM In | 7 DGM Out |
| 50 | 48 | 50 | 51 | | | | |
| 100 | 98 | 99 | 100 | | | | |
| 150 | 149 | 150 | 150 | | | | |
| 200 | 199 | 199 | 200 | | | | |
| 250 | 249 | 249 | 250 | | | | |
| 300 | 299 | 299 | 300 | | | | |
| 350 | 348 | 349 | 350 | | | | |
| 400 | 398 | 399 | 400 | | | | |
| 450 | 448 | 449 | 450 | | | | |
| 500 | 499 | 499 | 500 | | | | |
| 550 | 548 | 549 | 550 | | | | |
| 600 | 598 | 599 | 600 | | | | |

*Tolerance = ±2°F difference from reference setting.*

**Calibration Reference Information**

Reference Used: Omega CL23A Serial No: T-279500

Calibrated By: JH Metrology Exp. Date: 8/18/2010

Calibration Report No: R044791



CleanAir ENGINEERING

# Meter Box Critical Orifice Post-Test Calibration Data

| | | | | | |
|---|---|---|---|---|---|
| Project No. | 10955 | Meter No. | 61-6 | Orifice | C-4 |
| Location | Warehouse | Meter Yd | 0.9960 | Orifice K' | 0.4763 |
| Test Date | 12/15/2010 | Meter ΔH@ | 1.7601 | Orifice Cal. Date | 11/30/10 |
| Operator | G. Pavlovics | Full Test Cal. Date | 07/20/10 | | |

**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. ($P_b$) 29.00 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 - $\Delta Y_i$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.0 | 705.80 | 66 | 64 | | | | | | | | |
| 1 | 5.0 | 708.91 | 66 | 64 | 69 | 1.20 | 19 | 5.0 | 3.11 | 65.0 | 0.9879 | -0.4% |
| 2 | 10.0 | 712.01 | 67 | 65 | 69 | 1.10 | 19 | 5.0 | 3.10 | 65.5 | 0.9923 | 0.0% |
| 3 | 15.0 | 715.10 | 68 | 65 | 69 | 1.10 | 19 | 5.0 | 3.09 | 66.3 | 0.9969 | 0.5% |
| | | | | | | | | | | Average $Y_i$ | 0.9923 | |
| | | | | | | | | | | Cal. Error | -0.4% | |

**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

# Sample Probe Calibration

**Probe Type:** M5 with S-Type Pitot **I.D. Number:** 67-8-18

**Project Number:**

## Thermocouple Calibration

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

| Point No. | Target Temp. | Reference Temp. | Indicated Temp. | Temp. Difference | % Difference* | Specification |
|---|---|---|---|---|---|---|
| 1 | Ambient | 70 | 70 | 0 | 0.00% | |
| 2 | 200°F-250°F | 218 | 217 | 1 | 0.15% | %Difference ≤ 1.5 |

* Based on Absolute Temperature (Rankine)

**Does thermocouple assembly meet specifications?** → **YES**

## Pitot Tube Calibration (Wind Tunnel Method @ 49 ft/sec)

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

**Pitot Side 'A' :**

| Trial No. | Reference ΔP | Probe ΔP | Probe $C_{p(S)}$* | Abs. Deviation from Avg. $C_{p(A)}$** |
|---|---|---|---|---|
| 1 | 0.549 | 0.812 | 0.814 | 0.003 |
| 2 | 0.561 | 0.816 | 0.820 | 0.003 |
| 3 | 0.556 | 0.815 | 0.818 | 0.000 |
| | Side 'A' Average Probe $C_{p(A)}$= | | 0.8175 | 0.0021 |

Specification: Avg. $C_p$ Deviations ≤ 0.01

**Pitot Side 'B' :**

| Trial No. | Reference ΔP | Probe ΔP | Probe $C_{p(S)}$* | Abs. Deviation from Avg. $C_{p(B)}$** |
|---|---|---|---|---|
| 1 | 0.554 | 0.802 | 0.823 | 0.000 |
| 2 | 0.555 | 0.803 | 0.823 | 0.000 |
| 3 | 0.556 | 0.805 | 0.823 | 0.000 |
| | Side 'B' Average Probe $C_{p(B)}$= | | 0.8228 | 0.0000 |

Specification: Avg. $C_p$ Deviations ≤ 0.01

| 'A' Average $C_p$ | | 'B' Average $C_p$ | | Difference | Specification |
|---|---|---|---|---|---|
| 0.817 | — | 0.823 | = | -0.006 | \|Difference\| ≤ 0.01 |

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

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

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

Probe Cp= 0.820 Calibrated by: R ARNOLD Date: 03/04/2010

CleanAir ENGINEERING

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## FIELD DATA

E

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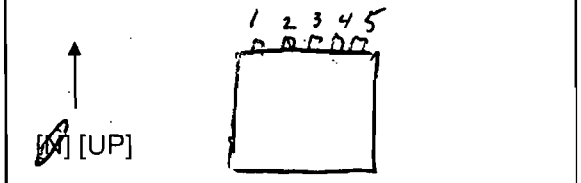
**TEST LOCATION:** FF outlet **Metals TESTING** **METHOD:** 29 **PAGE** 1 **OF** 2

**UNIT:** 3 **RUN:** 1

# FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Client | Wheelabrator | Project No | 10155 |
| Plant | N. Broward | Date | 12/8/10 |
| Meter Operator | K Sullivan | | |
| Probe Operator | N/A | | |

Cross-Section of Test Location




| | | | |
|---|---|---|---|
| Amb. Temp (°F) | 43 | Bar Press. | 30.04 [in Hg] [mbar] |
| Probe I.D. No | 67-8-18 | | |
| Liner Material | PYREX | | |

| | | | |
|---|---|---|---|
| Meter Box | 61-6 | Sample Box No | 118 |
| Meter $Y_d$ | 0.996 0 | Meter ΔH@ | 1.760 i |
| K Factor | 2.42 | Pitot $C_p$ | 0.82 |
| Leak Rate Before | 0.004 [cfm] [Lpm] | @ | 15 (in Hg) |
| Leak Rate After | 0.002 [cfm] [Lpm] | @ | 6 (in Hg) |
| Pitot Leak Check Before | ✓ | After Good ✓ Bad ☐ | |

| | | | |
|---|---|---|---|
| Filter No | N/A | | |
| Thimble No | N/A | | |
| Nozzle Diameter | 0.271 | Nozzle I.D. | 271-1 |

| | | | |
|---|---|---|---|
| Duct Dimensions (in.) | 96 x 96 | | |
| Static Pres. (in $H_2O$) | -10.7 | Port Len. (in.) | 9.0 |
| Gas Flow | [In] [Out] of page | First point all the way | [In] [Out] |

| | | | |
|---|---|---|---|
| Start Time | 804 | Stop Time | 1019 |

| Traverse Point Number | Min/pt 5 Elapsed Time | Velocity Head ΔP (in. $H_2O$) | Orifice Setting ΔH (in. $H_2O$) | Gas Sample Volume $V_m$ Init. Vol. 458.090 [ft³] [L] | Stack Temp Ts (°F) | Probe $T_p$ (°F) Set Points 250 | Filter $T_f$ (°F) Set Points 250 | Cond. Temp $T_c$ (°F) | DGM Inlet $T_{m\,in}$ (°F) | DGM Outlet $T_{m\,out}$ (°F) | Pump Vacuum (in. Hg) | XAD Trap Temp $T_x$ (°F) | Notes 0.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 5 | 0.30 | 0.73 | 460.50 | 304 | 250 | 249 | 48 | 42 | 41 | 3 | N/A | 9.7 |
| 2 | 10 | 0.28 | 0.68 | 462.75 | 294 | 253 | 244 | 51 | 42 | 41 | 3 | | 10.5 |
| 3 | 15 | 0.40 | 0.97 | 465.46 | 305 | 253 | 250 | 51 | 45 | 41 | 3 | | 10.3 |
| 4 | 20 | 0.55 | 1.3 | 468.57 | 307 | 250 | 250 | 51 | 46 | 42 | 4 | | 9.4 Port Δ Vol |
| 5 | 25 | 0.55 | 1.3 | 471.77 | 308 | 250 | 249 | 53 | 48 | 42 | 4 | | 10.0 i 471.77 f 478.50 Δ 7.03 |
| 2-1 | 30 | 0.63 | 1.5 | 476.17 | 307 | 247 | 251 | 55 | 48 | 43 | 4 | | 9.8 |
| 2 | 35 | 0.55 | 1.3 | 479.31 | 306 | 250 | 250 | 58 | 51 | 44 | 4 | | 9.8 |
| 3 | 40 | 0.57 | 1.21 | 482.57 | 306 | 253 | 250 | 59 | 53 | 45 | 4 | | 10.0 |
| 4 | 45 | 0.54 | 1.3 | 485.74 | 307 | 251 | 251 | 60 | 54 | 45 | 4 | | 10.7 Port Δ vol |
| 5 | 50 | 0.48 | 1.2 | 488.73 | 305 | 249 | 249 | 61 | 55 | 46 | 4 | | 9.9 i 485.73 f 489.53 Δ 3.80 |
| 3-1 | 55 | 0.68 | 1.6 | 493.08 | 306 | 248 | 250 | 62 | 54 | 47 | 5 | | 9.8 |
| 2 | 60 | 0.52 | 1.3 | 496.29 | 307 | 250 | 250 | 64 | 57 | 48 | 4 | | 9.9 |
| | | | | | | | | | | | | | |
| | Total | *17.7446 | 30.58 | 76.690 | 7646 | | | | 1367 | 1189 | | | |
| | Average | 0.7097 | 1.2232 | | 305.8400 | | | | 54.1200 | | | | |

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KS

Date 12/8/10

CleanAir ENGINEERING

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

**UNIT:** 3 **RUN:** 1

# FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Client | Wheelabrator | Project No. | 10955 |
| Plant | N Bonard | Date | 12/9/10 |
| Meter Operator | KS | | |
| Probe Operator | NA | | |

Cross-Section of Test Location

[N] [UP]

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

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

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

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

| | |
|---|---|
| Start Time | Stop Time |
| | |

| Traverse Point Number | Min/pt 5 Elapsed Time | Velocity Head $\Delta P$ ($in. H_2O$) | Orifice Setting $\Delta H$ ($in. H_2O$) | Gas Sample Volume $V_m$ Init. Vol. 496.29 [L] | Stack Temp. Ts (°F) | Probe $T_p$ (°F) Set Points | Filter $T_f$ (°F) Set Points | Cond Temp. $T_c$ (°F) | DGM Inlet $T_{m\,in}$ (°F) | DGM Outlet $T_{m\,out}$ (°F) | Pump Vacuum (in Hg) | XAD Trap Temp $T_t$ (°F) | Notes $O_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-3 | 65 | 0.55 | 1.3 | 499.48 | 307 | 253 | 250 | 65 | 57 | 48 | 4 | N/A | 10.6 |
| 4 | 70 | 0.53 | 1.3 | 502.78 | 307 | 249 | 251 | 59 | 58 | 49 | 4 | | 10.2 |
| 5 | 75 | 0.51 | 1.2 | 505.72 | 306 | 249 | 249 | 53 | 59 | 50 | 4 | | 10.5 |
| 4-1 | 80 | 0.51 | 1.2 | 508.79 | 305 | 248 | 250 | 53 | 58 | 50 | 4 | | 10.9 |
| 2 | 85 | 0.59 | 1.4 | 512.12 | 308 | 247 | 248 | 50 | 59 | 50 | 4 | | 10.3 |
| 3 | 90 | 0.53 | 1.3 | 515.30 | 307 | 250 | 253 | 59 | 59 | 51 | 4 | | 10.6 |
| 4 | 95 | 0.48 | 1.2 | 518.36 | 307 | 252 | 250 | 48 | 60 | 51 | 4 | | 10.8 |
| 5 | 100 | 0.48 | 1.2 | 521.42 | 307 | 249 | 249 | 48 | 60 | 51 | 4 | | 10.6 |
| 5-1 | 105 | 0.49 | 1.2 | 525.15 | 303 | 249 | 250 | 49 | 57 | 52 | 4 | | 10.8 |
| 2 | 110 | 0.51 | 1.2 | 528.20 | 307 | 249 | 250 | 49 | 60 | 53 | 4 | | 10.8 |
| 3 | 115 | 0.51 | 1.2 | 531.27 | 307 | 250 | 252 | 49 | 61 | 53 | 4 | | 10.6 |
| 4 | 120 | 0.48 | 1.2 | 534.29 | 307 | 251 | 250 | 50 | 61 | 53 | 4 | | 10.5 |
| 5 | 125 | 0.45 | 1.1 | 537.260 | 306 | 250 | 250 | 57 | 61 | 53 | 4 | | 10.2 |
| | Total | * | | | | | | | | | | | |
| | Average | | | | | | | | | | | | |

KS

Port 4 Vp1 521.42

f 532.07

0.65

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KS

Date 12/10

CleanAir ENGINEERING

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

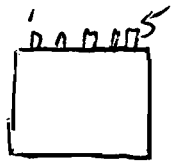
UNIT: 3 RUN: 2

# FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Client | Wheelabrator | Project No | 10355 |
| Plant | N Seward | Date | 12/8/10 |
| Meter Operator | K Sullivan | | |
| Probe Operator | N/A | | |

Cross-Section of Test Location

[X] [UP]



| | | | |
|---|---|---|---|
| Amb. Temp. (°F) | 55 | Bar. Press. | 30.04 [in Hg] [mbar] |
| Probe I.D. No. | 27-S-15 | | |
| Liner Material | Pyrex | | |

| | | | |
|---|---|---|---|
| Meter Box | 61-B | Sample Box No. | MM |
| Meter $Y_d$ | 0.9960 | Meter $\Delta H@$ | 1.7601 |
| K Factor | 2.42 | Pitot $C_p$ | 0.82 |
| Leak Rate Before | 0.010 [cfm] [Lpm] | @ | 15 (in Hg) |
| Leak Rate After | 0.004 [cfm] [Lpm] | @ | 6 (in Hg) |
| Pitot Leak Check Before | [X] | After: Good | [X] Bad [ ] |

| | | | |
|---|---|---|---|
| Filter No. | N/A | | |
| Thimble No. | N/A | | |
| Nozzle Diameter | 0.271 | Nozzle I.D. | 271-1 |

| | | | |
|---|---|---|---|
| Duct Dimensions (in.) | 96 x 96 | | |
| Static Pres ($in\ H_2O$) | -10.6 | Port Len (in.) | 9.0 |
| Gas Flow | [In] [Out] of page | First point all the way | [X] [Out] |

| | | | |
|---|---|---|---|
| Start Time | 10:45 | Stop Time | 12:53 |

| Traverse Point Number | Min/pt 5 Elapsed Time | Velocity Head $\Delta P$ ($in\ H_2O$) | Orifice Setting $\Delta H$ ($in\ H_2O$) | Gas Sample Volume $V_m$ [ft³] [L] Init. Vol. 538.680 | 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 $T_{m\,in}$ (°F) | DGM Outlet $T_{m\,out}$ (°F) | Pump Vacuum (in Hg) | XAD Trap Temp $T_t$ (°F) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-1 | 5 | 0.57 | 1.4 | 542.03 | 308 | 257 | 247 | 53 | 57 | 54 | 4 | 9.7 | |
| 2 | 10 | 0.55 | 1.3 | 545.23 | 307 | 249 | 247 | 49 | 59 | 55 | 4 | 10.3 | |
| 3 | 15 | 0.52 | 1.3 | 548.49 | 307 | 251 | 249 | 49 | 61 | 55 | 4 | 9.3 | |
| 4 | 20 | 0.50 | 1.2 | 551.45 | 307 | 251 | 251 | 52 | 63 | 56 | 4 | 10.7 | |
| 5 | 25 | 0.42 | 1.0 | 554.34 | 300 | 250 | 250 | 54 | 64 | 56 | 4 | 10.3 | |
| 4-1 | 30 | 0.53 | 1.3 | 557.52 | 307 | 250 | 250 | 54 | 65 | 57 | 4 | 10.7 | |
| 2 | 35 | 0.55 | 1.3 | 560.77 | 308 | 248 | 250 | 54 | 65 | 57 | 4 | 10.3 | |
| 3 | 40 | 0.53 | 1.3 | 563.98 | 308 | 251 | 250 | 53 | 65 | 58 | 4 | 10.5 | |
| 4 | 45 | 0.50 | 1.2 | 567.05 | 309 | 251 | 252 | 55 | 66 | 58 | 4 | 10.0 | |
| 5 | 50 | 0.46 | 1.1 | 570.00 | 306 | 250 | 250 | 58 | 66 | 58 | 4 | 11.0 | |
| 3-1 | 55 | 0.67 | 1.5 | 573.45 | 307 | 250 | 250 | 59 | 67 | 59 | 5 | 11.4 | |
| 2 | 60 | 0.57 | 1.4 | 576.82 | 308 | 249 | 250 | 60 | 68 | 59 | 5 | 11.2 | |
| | | | | | | | | | | | | | |
| | Total | *12.8054 | 30.77 | 78.620 | 7621 | | | | 1691 | 1499 | | | |
| | Average | 0.7122 | 1.2308 | | 306.8400 | | | | 63.9000 | | | | |

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KS

Date 12/8/10

CleanAir ENGINEERING

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

**UNIT:** 3 **RUN:** 2

# FIELD DATA SHEET

| | |
|---|---|
| Client: Wheelabrator | Project No.: 10955 |
| Plant: N Brunswick | Date: 12/8/10 |
| Meter Operator: KS | |
| Probe Operator: NA | |

Cross-Section of Test Location

[N] [UP]

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

| | | |
|---|---|---|
| Meter Box: | Sample Box No.: | |
| Meter Y: | Meter ΔH@: | |
| K Factor: | Pitot $C_p$: | |
| Leak Rate Before: [cfm] [Lpm] @ (in Hg) | | |
| Leak Rate After: [cfm] [Lpm] @ (in Hg) | | |
| Pitot Leak Check Before ☐ After: Good ☐ Bad ☐ | | |

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

| | | |
|---|---|---|
| Filter No.: | | |
| Thimble No.: | | |
| Nozzle Diameter: | Nozzle I.D.: | |

| | |
|---|---|
| Start Time: | Stop Time: |

| Traverse Point Number | Min/pt 5 Elapsed Time | Velocity Head ΔP (in. $H_2O$) | Orifice Setting ΔH (in. $H_2O$) | Gas Sample Volume $V_m$ Init. Vol. 576.82 [ft³] [L] | Stack Temp. Ts (°F) | Probe $T_p$ (°F) Set Points | Filter $T_f$ (°F) Set Points | Cond. Temp $T_c$ (°F) | DGM Inlet $T_{m\,in}$ (°F) | DGM Outlet $T_{m\,out}$ (°F) | Pump Vacuum (in.Hg) | XAD Trap Temp $T_t$ (°F) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-3 | 65 | 0.50 | 1.2 | 579.91 | 308 | 252 | 250 | 62 | 68 | 60 | 4 | 10.9 | |
| 4 | 70 | 0.47 | 1.1 | 582.55 | 308 | 250 | 250 | 65 | 69 | 60 | 4 | 10.6 | |
| 5 | 75 | 0.42 | 1.0 | 585.76 | 308 | 250 | 249 | 63 | 68 | 61 | 4 | 10.9 | |
| 2-1 | 81 | 0.65 | 1.6 | 589.32 | 307 | 249 | 251 | 55 | 68 | 61 | 5 | 11.3 | |
| 2 | 85 | 0.55 | 1.3 | 592.60 | 308 | 249 | 250 | 53 | 70 | 62 | 5 | 11.8 | |
| 3 | 90 | 0.57 | 1.4 | 595.99 | 311 | 252 | 251 | 50 | 70 | 62 | 5 | 11.2 | |
| 4 | 95 | 0.52 | 1.3 | 599.27 | 309 | 251 | 250 | 48 | 72 | 63 | 5 | 11.5 | |
| 5 | 100 | 0.50 | 1.2 | 602.40 | 308 | 249 | 250 | 48 | 72 | 63 | 5 | 11.5 | |
| 1-1 | 105 | 0.42 | 1.0 | 605.35 | 305 | 249 | 250 | 48 | 74 | 64 | 4 | 10.4 | |
| 2 | 110 | 0.42 | 1.0 | 608.25 | 301 | 249 | 248 | 48 | 74 | 65 | 4 | 11.5 | |
| 3 | 115 | 0.40 | 0.97 | 611.07 | 303 | 251 | 254 | 47 | 74 | 65 | 4 | 11.7 | |
| 4 | 120 | 0.47 | 1.1 | 614.08 | 306 | 250 | 251 | 48 | 73 | 65 | 4 | 11.6 | |
| 5 | 125 | 0.52 | 1.3 | 617.300 | 307 | 250 | 250 | 48 | 74 | 66 | 4 | 11.5 | |
| | Total | * | | | | | | | | | | | |
| | Average | | | | | | | | | | | | |

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KS

Date 12/8/10





CleanAir ENGINEERING

TEST LOCATION: FFoutlet Metals TESTING METHOD: 29 PAGE 1 OF 2

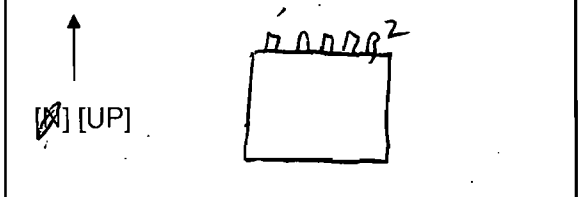
UNIT: 3 RUN: 3

# FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Client | Wheelabrator | Project No | 10955 |
| Plant | N Brownsville | Date | 12/8/10 |
| Meter Operator | K Sullivan | | |
| Probe Operator | N/A | | |

| | | | |
|---|---|---|---|
| Meter Box | 61-6 | Sample Box No | MB |
| Meter Y | 0.996 | Meter ΔH@ | 1.761 |
| K Factor | 2.42 | Pitot Cp | 0.82 |
| Leak Rate Before | 0.003 [cfm] [Lpm] | @ | 12 (in Hg) |
| Leak Rate After | 0.001 [cfm] [Lpm] | @ | 5 (in Hg) |
| Pitot Leak Check Before ☑ | After Good ☑ | Bad ☐ | |

Cross-Section of Test Location




| Duct Dimensions (in.) | 96 x 96 | | |
|---|---|---|---|
| Static Pres (in. $H_2O$) | Port Len (in.) | Gas Flow [In] [Out] of page | First point all the way [In] [Out] |
| -10.4 | 9.0 | | |

| | | | |
|---|---|---|---|
| Amb. Temp (°F) | 70 | Bar. Press | 30.04 [in. Hg] [mbar] |
| Probe I.D. No | 67-8-18 | | |
| Liner Material | PyRex | | |

| | | | |
|---|---|---|---|
| Filter No | N/A | | |
| Thimble No | N/A | | |
| Nozzle Diameter | 0.221 | Nozzle I.D. | 221-1 |

| | |
|---|---|
| Start Time | 13:10 |
| Stop Time | 15:15 |

| Traverse Point Number | Min/pt 5 Elapsed Time | Velocity Head ΔP (in. $H_2O$) | Orifice Setting ΔH (in. $H_2O$) | Gas Sample Volume $V_m$ Init. Vol. 618.165 [ft³] [L] | 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 $T_{m\,in}$ (°F) | DGM Outlet $T_{m\,out}$ (°F) | Pump Vacuum (in Hg) | XAD Trap Temp (°F) 70 | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 5 | 0.53 | 1.3 | 621.58 | 306 | 240 | 241 | 65 | 66 | 65 | 4 | 11.8 | |
| 2 | 10 | 0.45 | 1.1 | 624.54 | 300 | 254 | 252 | 64 | 73 | 67 | 3 | 11.9 | |
| 3 | 15 | 0.35 | 0.85 | 627.21 | 307 | 253 | 251 | 65 | 75 | 67 | 3 | 11.4 | |
| 4 | 20 | 0.45 | 1.1 | 630.30 | 307 | 252 | 250 | 56 | 76 | 68 | 4 | 11.0 | |
| 5 | 25 | 0.40 | 0.97 | 633.17 | 306 | 249 | 250 | 51 | 77 | 68 | 4 | 10.2 | |
| 2-1 | 30 | 0.60 | 1.5 | 636.75 | 307 ~~302~~ KS | 249 | 250 | 49 | 79 | 69 | 5 | 11.0 | |
| 2 | 35 | 0.56 | 1.4 | 640.10 | 309 | 247 | 250 | 48 | 80 | 69 | 4 | 10.9 | |
| 3 | 40 | 0.50 | 1.2 | 643.20 | 309 | 252 | 251 | 48 | 80 | 70 | 4 | 10.8 | |
| 4 | 45 | 0.45 | 1.1 | 646.19 | 308 | 251 | 249 | 49 | 80 | 71 | 4 | 11.2 | |
| 5 | 50 | 0.37 | 0.90 | 648.97 | 307 | 250 | 250 | 49 | 82 | 71 | 3 | 11.4 | |
| 3-1 | 55 | 0.57 | 1.4 | 652.42 | 308 | 250 | 250 | 50 | 84 | 72 | 4 | 12.1 | |
| 2 | 60 | 0.50 | 1.2 | 655.57 | 309 | 247 | 249 | 51 | 86 | 73 | 4 | 12.1 | |
| | | | | | | | | | | | | | |
| | Total | *17.2377 | 29.19 | 37.745 | 7725 | | | | 2080 | 1842 | | | |
| | Average | 0.6895 | 1.1676 | | 309.0000 | | | | 78.4400 | | | | |

*Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KS

Date 12/8/10

CleanAir ENGINEERING

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

UNIT: 3 RUN: 3

# FIELD DATA SHEET

| | | | |
|---|---|---|---|
| Client | Wheelabrator | Project No | 10953 |
| Plant | N Howards | Date | 12/8/10 |
| Meter Operator | KS | | |
| Probe Operator | N/A | | |

Cross-Section of Test Location

[N] [UP]

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

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

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

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

| | |
|---|---|
| Start Time | Stop Time |

| Traverse Point Number | Min/pt 5 Elapsed Time | Velocity Head ΔP (in. $H_2O$) | Orifice Setting ΔH (in. $H_2O$) | Gas Sample Volume $V_m$ Init. Vol. 655.51 [L] | Stack Temp Ts (°F) | Probe $T_p$ (°F) Set Points | Filter $T_f$ (°F) Set Points | Cond Temp $T_c$ (°F) | DGM Inlet $T_{m\,in}$ (°F) | DGM Outlet $T_{m\,out}$ (°F) | Pump Vacuum (in Hg) | XAD Trap Temp $T_t$ (°F) / $O_2$ | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-3 | 65 | 0.47 | 1.1 | 658.49 | 310 | 252 | 250 | 52 | 87 | 74 | 4 | 11.3 | |
| 4 | 70 | 0.45 | 1.1 | 661.45 | 310 | 251 | 251 | 54 | 87 | 75 | 4 | 12.0 | |
| 5 | 75 | 0.45 | 1.1 | 664.45 | 310 | 250 | 250 | 55 | 87 | 76 | 4 | 12.1 | |
| 4-1 | 80 | 0.60 | 1.5 | 668.01 | 310 | 250 | 250 | 56 | 87 | 77 | 5 | 11.7 | |
| 2 | 85 | 0.55 | 1.3 | 671.29 | 310 | 246 | 249 | 53 | 88 | 78 | 4 | 12.5 | |
| 3 | 90 | 0.53 | 1.3 | 674.64 | 311 | 252 | 250 | 51 | 88 | 78 | 4 | 12.2 | |
| 4 | 95 | 0.48 | 1.2 | 677.78 | 311 | 251 | 250 | 51 | 87 | 78 | 4 | 13.0 | |
| 5 | 100 | 0.45 | 1.1 | 680.88 | 312 | 250 | 250 | 51 | 88 | 79 | 4 | 13.3 | |
| 5-1 | 105 | 0.48 | 1.2 | 683.97 | 309 | 249 | 250 | 52 | 89 | 79 | 4 | 13.0 | |
| 2 | 110 | 0.45 | 1.1 | 687.01 | 314 | 247 | 249 | 53 | 88 | 79 | 4 | 12.9 | |
| 3 | 115 | 0.45 | 1.1 | 690.03 | 312 | 252 | 250 | 53 | 88 | 79 | 4 | 12.7 | |
| 4 | 120 | 0.45 | 1.1 | 693.03 | 312 | 251 | 250 | 53 | 89 | 80 | 4 | 12.6 | |
| 5 | 125 | 0.40 | 0.97 | 695.916 | 311 | 249 | 249 | 54 | 89 | 80 | 4 | 12.5 | |
| | Total | * | | | | | | | | | | | |
| | Average | | | | | | | | | | | | |

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC KS

Date 12/8/10





CleanAir ENGINEERING

# Impinger Weight Sheet

| | | | |
|---|---|---|---|
| Client Wheelabrator | | | Unit Name / Location 3/FF Outlet |
| Plant N. Broward 3 | Job No. 10955 | | Method 29 |

| Balance Calibration | | | |
|---|---|---|---|
| Reference Weight ID | 601S1 | Reference Weight Reading | 499.3 |
| Reference Weight Mass | 500 | Reference Weight Mass must agree with Reference Weight Reading to within ±0.5 g. | |

| | | | |
|---|---|---|---|
| Run No. 1 | Filter Type Quartz | | Sample Box No. M8 |
| Date 12/8/10 | Lot No. — | | pH |
| Analyst C. Slimp | Filter No. R1 | | Rinse — |

| | Contents | Gross Weight (gm) | Tare Weight (gm) | Net Weight Gain (gm) | |
|---|---|---|---|---|---|
| Impinger 1 | Empty | 607.7 | 415.7 | 192.0 | |
| Impinger 2 | 100mL 5% $HNO_3$/10% $H_2O_2$ | 665.5 | 545.3 | 140.2 | QA/QC CS |
| Impinger 3 | " | 590.9 | 545.5 | 45.4 | Date 12/8/10 |
| Impinger 4 | Empty | 462.8 | 450.8 | 12.0 | |
| Impinger 5 | 100mL 4% $KMnO_4$/10% $H_2SO_4$ | 542.6 | 537.6 | 5.0 | Total Weight (gm) |
| Impinger 6 | " | 566.7 | 565.9 | 0.8 | 395.4 |
| Impinger 7 | Silica Gel | 751.8 | 730.7 | 21.1 | 416.5 |

| | | | |
|---|---|---|---|
| Run No. 2 | Filter Type Quartz | | Sample Box No. M4 |
| Date 12/8/10 | Lot No. | | pH — |
| Analyst C. Slimp | Filter No. R2 | | Rinse — |

| | Contents | Gross Weight (gm) | Tare Weight (gm) | Net Weight Gain (gm) | |
|---|---|---|---|---|---|
| Impinger 1 | Empty | 606.4 | 428.8 | 177.6 | |
| Impinger 2 | 100mL 5% $HNO_3$/10% $H_2O_2$ | 730.5 | ~~621.1~~ 621.1 | 109.4 | QA/QC CS |
| Impinger 3 | " | 589.0 | ~~536.3~~ ~~550.7~~ 536.7 | 52.7 | Date 12/8 |
| Impinger 4 | Empty | 478.4 | 456.1 | 22.3 | |
| Impinger 5 | 100mL 4% $KMnO_4$/10% $H_2SO_4$ | 554.4 | 545.8 | 8.6 | Total Weight (gm) |
| Impinger 6 | " | 540.0 | 538.1 | 1.9 | SB ~~382.5~~ 372.5 |
| Impinger 7 | Silica Gel | 750.6 | 728.0 | 22.6 | SB ~~405.1~~ 395.1 |

| | | | |
|---|---|---|---|
| Run No. 3 | Filter Type Quartz | | Sample Box No. M8 |
| Date 12/8/10 | Lot No. | | pH — |
| Analyst C. Slimp | Filter No. R3 | | Rinse — |

| | Contents | Gross Weight (gm) | Tare Weight (gm) | Net Weight Gain (gm) | |
|---|---|---|---|---|---|
| Impinger 1 | Empty | 695.6 | 419.2 | 276.4 | |
| Impinger 2 | 100mL 5% $HNO_3$/10% $H_2O_2$ | 629.5 | 546.7 | 82.8 | QA/QC CS |
| Impinger 3 | " | 563.3 | 548.5 | 14.8 | Date 12/8 |
| Impinger 4 | Empt | 455.3 | 452.9 | 2.4 | |
| Impinger 5 | 100mL 4% $KMnO_4$/10% $H_2SO_4$ | 541.9 | 541.7 | 0.2 | Total Weight (gm) |
| Impinger 6 | " | 547.9 | 548.3 | -0.4 | SB ~~374.2~~ 376.2 |
| Impinger 7 | Silica Gel | 767.3 | 751.5 | 15.8 | SB ~~410.0~~ 392.0 |

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QA/QC CS
Date 12/8/10

# ORSAT READINGS

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

| | | | |
|---|---|---|---|
| Client: Wheelabrator | Project Number: 10955 | $Fo = \frac{20.9 - \%O_2}{\%CO_2}$ | |
| Plant: N. Broward | Unit: 3 | | |
| Orsat ID: 6 | Fuel Type: Waste | Leak Check Passed ☑ | |

| Run Number | Method Number | Trial | Percent $CO_2$ | Percent $O_2+CO_2$ | Percent $O_2$ | $F_O$ | Analyst | Analysis Date | Analysis Time |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 29 | 1 | 8.2 | 19.0 | 10.8 | 1.23 | C. Slimp | 12/8 | 13:20 |
| | | 2 | 8.2 | 19.0 | 10.8 | | | | |
| | | 3 | 8.4 | 19.0 | 10.6 | | | | |
| | | Avg. | 8.26 | | 10.73 | | | | |
| 2 | 29 | 1 | 8.2 | 19.0 | 10.8 | 1.23 | C. Slimp | 12/8 | 13:45 |
| | | 2 | 8.2 | 19.0 | 10.8 | | | | |
| | | 3 | 8.2 | 18.8 | 10.6 | | | | |
| | | Avg. | 8.2 | | 10.73 | 1.18 | | | |
| 3 | 29 | 1 | 9.0 | ~~19.2~~ 19.2 | 10.4 | ~~1.23~~ | C. Slimp | 12/8 | ~~13837~~ |
| | | 2 | 8.8 | 19.0 | 10.2 | | | | |
| | | 3 | 9.0 | 19.0 | 10.0 | | | | |
| | | Avg. | 9.0 | 19.06 | 10.2 | | | | |
| | | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | Avg. | | | | | | | |
| | | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | Avg. | | | | | | | |
| | | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | Avg. | | | | | | | |

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

Acceptable ranges for $F_O$:

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



QA/QC CS
Date 12/8

## FIELD DATA PRINTOUTS

F

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## Field Data Printout

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

Location: Unit 3 FF Outlet
Test Run: 1
Client: Wheelabrator North Broward, Inc.
Project No: 10955
Source Area ($ft^2$): 64.00000
Meter Operator:
Probe Operator:
Test Date: 12/08/10
Start Time: 08:04
Stop Time: 10:19
Leak Rate Before: 0.004 cfm @ 15 "Hg
Leak Rate After: 0.002 cfm @ 6 "Hg

Bar. Press. (in. Hg): 30.04
Static P: -10.7
$O_2$ (dry volume %): 10.73
$CO_2$ (dry volume %): 8.27
$N_2$+CO (dry volume %): 81.00
$H_2O$ (condensate, ml or gm): 395.4
$H_2O$ (silica, g): 21.1
Actual Moisture (%): 19.79

Nozzle ID No: 271-1
Nozzle Diameter ($D_n$): 0.271
Probe ID No: 67-8-18
Pitot $C_p$: 0.8200
Pitot Leak Check: ☑ Pass ☐ Fail
Meter Box ID. No: 61-6
Meter ΔH@: 1.76010
Meter $Y_d$: 0.99600

| Traverse Point | Run Time 5.0 min/read | Pitot $\Delta P_s$ (in. $H_2O$) | Sample $\Delta H$ (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 | | | 458.090 | | | | | | |
| 1-01 | 5.0 | 0.30 | 0.73 | 460.500 | 304 | 42 | 41 | 0.55 | 2.41 | 104.2 |
| 1-02 | 10.0 | 0.28 | 0.68 | 462.750 | 294 | 42 | 41 | 0.53 | 2.25 | 100.0 |
| 1-03 | 15.0 | 0.40 | 0.97 | 465.460 | 305 | 45 | 41 | 0.63 | 2.71 | 101.3 |
| 1-04 | 20.0 | 0.55 | 1.30 | 468.570 | 307 | 46 | 42 | 0.74 | 3.11 | 99.1 |
| 1-05 | 25.0 | 0.55 | 1.30 | 471.770 | 308 | 48 | 42 | 0.74 | 3.20 | 101.9 |
| LEAK CHECK | 25.0 | | | 472.800 | | | | | | |
| 2-01 | 30.0 | 0.63 | 1.50 | 476.170 | 307 | 48 | 43 | 0.79 | 3.37 | 100.1 |
| 2-02 | 35.0 | 0.55 | 1.30 | 479.310 | 306 | 51 | 44 | 0.74 | 3.14 | 99.3 |
| 2-03 | 40.0 | 0.57 | 1.40 | 482.570 | 306 | 53 | 45 | 0.75 | 3.26 | 101.0 |
| 2-04 | 45.0 | 0.54 | 1.30 | 485.740 | 307 | 54 | 45 | 0.73 | 3.17 | 100.9 |
| 2-05 | 50.0 | 0.48 | 1.20 | 488.730 | 305 | 55 | 46 | 0.69 | 2.99 | 100.6 |
| LEAK CHECK | 50.0 | | | 489.530 | | | | | | |
| 3-01 | 55.0 | 0.68 | 1.60 | 493.080 | 306 | 54 | 47 | 0.82 | 3.55 | 100.5 |
| 3-02 | 60.0 | 0.54 | 1.30 | 496.290 | 307 | 57 | 48 | 0.73 | 3.21 | 101.6 |
| 3-03 | 65.0 | 0.55 | 1.30 | 499.480 | 307 | 57 | 48 | 0.74 | 3.19 | 100.0 |
| 3-04 | 70.0 | 0.53 | 1.30 | 502.780 | 307 | 58 | 49 | 0.73 | 3.30 | 105.2 |
| 3-05 | 75.0 | 0.51 | 1.20 | 505.720 | 306 | 59 | 50 | 0.71 | 2.94 | 95.3 |
| 4-01 | 80.0 | 0.51 | 1.20 | 508.790 | 305 | 58 | 50 | 0.71 | 3.07 | 99.5 |
| 4-02 | 85.0 | 0.59 | 1.40 | 512.120 | 308 | 59 | 50 | 0.77 | 3.33 | 100.5 |
| 4-03 | 90.0 | 0.53 | 1.30 | 515.300 | 307 | 59 | 51 | 0.73 | 3.18 | 101.1 |
| 4-04 | 95.0 | 0.48 | 1.20 | 518.360 | 307 | 60 | 51 | 0.69 | 3.06 | 102.1 |
| 4-05 | 100.0 | 0.48 | 1.20 | 521.420 | 307 | 60 | 51 | 0.69 | 3.06 | 102.1 |
| LEAK CHECK | 100.0 | | | 522.070 | | | | | | |
| 5-01 | 105.0 | 0.49 | 1.20 | 525.150 | 303 | 59 | 52 | 0.70 | 3.08 | 101.4 |
| 5-02 | 110.0 | 0.51 | 1.20 | 528.200 | 307 | 60 | 53 | 0.71 | 3.05 | 98.5 |
| 5-03 | 115.0 | 0.51 | 1.20 | 531.270 | 307 | 61 | 53 | 0.71 | 3.07 | 99.0 |
| 5-04 | 120.0 | 0.48 | 1.20 | 534.290 | 307 | 61 | 53 | 0.69 | 3.02 | 100.4 |
| 5-05 | 125.0 | 0.45 | 1.10 | 537.260 | 306 | 61 | 53 | 0.67 | 2.97 | 101.9 |
| Final | 125.0 | | 1.22320 | 76.69000 | 305.84000 | 51.12000 | | 0.70967 | 76.69000 | |
| 25 points sampled | | Sq.Rt.ΔP | | | | | | | | |
| QC-Check: Field Averages | | 0.7097 | 1.2232 | 76.6900 | 305.8400 | 51.1200 | | | | |
| | | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | | | | |

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Date _____

## Field Data Printout

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

Location: Unit 3 FF Outlet
Test Run: 2
Client: Wheelabrator North Broward, Inc.
Project No: 10955
Source Area ($ft^2$): 64.00000
Meter Operator:
Probe Operator:
Test Date: 12/08/10
Start Time: 10:45
Stop Time: 12:53
Leak Rate Before: 0.010 cfm @ 15 "Hg
Leak Rate After: 0.004 cfm @ 6 "Hg

Bar. Press. (in. Hg): 30.04
Static P: -10.6
$O_2$ (dry volume %): 10.73
$CO_2$ (dry volume %): 8.20
$N_2$+CO (dry volume %): 81.07
$H_2O$ (condensate, ml or gm): 372.5
$H_2O$ (silica, g): 22.6
Actual Moisture (%): 18.96

Nozzle ID No: 271-1
Nozzle Diameter ($D_n$): 0.271
Probe ID No: 67-8-18
Pitot $C_p$: 0.8200
Pitot Leak Check: ☑ Pass ☐ Fail
Meter Box ID. No: 61-6
Meter ΔH@: 1.76010
Meter $Y_d$: 0.99600

| Traverse Point | Run Time 5.0 min/read | Pitot $\Delta P_s$ (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 | | | 538.680 | | | | | | |
| 5-01 | 5.0 | 0.57 | 1.40 | 542.030 | 308 | 57 | 54 | 0.75 | 3.35 | 101.7 |
| 5-02 | 10.0 | 0.55 | 1.30 | 545.230 | 307 | 59 | 55 | 0.74 | 3.20 | 98.6 |
| 5-03 | 15.0 | 0.52 | 1.30 | 548.410 | 307 | 61 | 55 | 0.72 | 3.18 | 100.5 |
| 5-04 | 20.0 | 0.50 | 1.20 | 551.450 | 307 | 63 | 56 | 0.71 | 3.04 | 97.7 |
| 5-05 | 25.0 | 0.42 | 1.00 | 554.340 | 300 | 64 | 56 | 0.65 | 2.89 | 100.7 |
| 4-01 | 30.0 | 0.53 | 1.30 | 557.520 | 307 | 65 | 57 | 0.73 | 3.18 | 99.0 |
| 4-02 | 35.0 | 0.55 | 1.30 | 560.770 | 308 | 65 | 57 | 0.74 | 3.25 | 99.4 |
| 4-03 | 40.0 | 0.53 | 1.30 | 563.980 | 308 | 65 | 58 | 0.73 | 3.21 | 99.9 |
| 4-04 | 45.0 | 0.50 | 1.20 | 567.050 | 309 | 66 | 58 | 0.71 | 3.07 | 98.3 |
| 4-05 | 50.0 | 0.46 | 1.10 | 570.000 | 306 | 66 | 58 | 0.68 | 2.95 | 98.3 |
| 3-01 | 55.0 | 0.62 | 1.50 | 573.450 | 307 | 67 | 59 | 0.79 | 3.45 | 99.0 |
| 3-02 | 60.0 | 0.57 | 1.40 | 576.820 | 308 | 68 | 59 | 0.75 | 3.37 | 100.8 |
| 3-03 | 65.0 | 0.50 | 1.20 | 579.910 | 308 | 68 | 60 | 0.71 | 3.09 | 98.5 |
| 3-04 | 70.0 | 0.47 | 1.10 | 582.850 | 308 | 68 | 60 | 0.69 | 2.94 | 96.7 |
| 3-05 | 75.0 | 0.42 | 1.00 | 585.760 | 308 | 68 | 61 | 0.65 | 2.91 | 101.1 |
| 2-01 | 80.0 | 0.65 | 1.60 | 589.320 | 307 | 68 | 61 | 0.81 | 3.56 | 99.5 |
| 2-02 | 85.0 | 0.55 | 1.30 | 592.600 | 308 | 70 | 62 | 0.74 | 3.28 | 99.4 |
| 2-03 | 90.0 | 0.57 | 1.40 | 595.990 | 311 | 70 | 62 | 0.75 | 3.39 | 101.1 |
| 2-04 | 95.0 | 0.52 | 1.30 | 599.270 | 309 | 72 | 63 | 0.72 | 3.28 | 102.0 |
| 2-05 | 100.0 | 0.50 | 1.20 | 602.400 | 308 | 72 | 63 | 0.71 | 3.13 | 99.1 |
| 1-01 | 105.0 | 0.42 | 1.00 | 605.350 | 305 | 74 | 64 | 0.65 | 2.95 | 101.4 |
| 1-02 | 110.0 | 0.42 | 1.00 | 608.250 | 301 | 74 | 65 | 0.65 | 2.90 | 99.3 |
| 1-03 | 115.0 | 0.40 | 0.97 | 611.070 | 303 | 74 | 65 | 0.63 | 2.82 | 99.1 |
| 1-04 | 120.0 | 0.47 | 1.10 | 614.080 | 306 | 73 | 65 | 0.69 | 3.01 | 97.9 |
| 1-05 | 125.0 | 0.52 | 1.30 | 617.300 | 307 | 74 | 66 | 0.72 | 3.22 | 99.5 |
| Final | 125.0 | | 1.23080 | 78.62000 | 306.84000 | 63.80000 | | 0.71221 | 78.62000 | |
| 25 points sampled | | Sq.Rt.ΔP | | | | | | | | |
| QC-Check: Field Averages | | 0.7122 | 1.2308 | 78.6200 | 306.8400 | 63.8000 | | | | |
| | | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | | | | |

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Date _____

## Field Data Printout

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

Location: Unit 3 FF Outlet
Test Run: 3
Client: Wheelabrator North Broward, Inc.
Project No: 10955
Source Area ($ft^2$): 64.00000
Meter Operator:
Probe Operator:
Test Date: 12/08/10
Start Time: 13:10
Stop Time: 15:15
Leak Rate Before: 0.003 cfm @ 12 "Hg
Leak Rate After: 0.001 cfm @ 5 "Hg

Bar. Press. (in. Hg): 30.04
Static P: -10.4
$O_2$ (dry volume %): 10.13
$CO_2$ (dry volume %): 8.93
$N_2$+CO (dry volume %): 80.93
$H_2O$ (condensate, ml or gm): 376.2
$H_2O$ (silica, g): 15.8
Actual Moisture (%): 19.44

Nozzle ID No: 271-1
Nozzle Diameter ($D_n$): 0.271
Probe ID No: 67-8-18
Pitot $C_p$: 0.8200
Pitot Leak Check: ☑ Pass ☐ Fail

Meter Box ID. No: 61-6
Meter $\Delta H@$: 1.76010
Meter $Y_d$: 0.99600

| Traverse Point | Run Time 5.0 min/read | Pitot $\Delta P_s$ (in. $H_2O$) | Sample $\Delta H$ (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 | | | 618.165 | | | | | | |
| 1-01 | 5.0 | 0.53 | 1.30 | 621.580 | 306 | 66 | 65 | 0.73 | 3.42 | 106.0 |
| 1-02 | 10.0 | 0.45 | 1.10 | 624.540 | 300 | 73 | 67 | 0.67 | 2.96 | 98.4 |
| 1-03 | 15.0 | 0.35 | 0.85 | 627.210 | 307 | 75 | 67 | 0.59 | 2.67 | 100.9 |
| 1-04 | 20.0 | 0.45 | 1.10 | 630.300 | 307 | 76 | 68 | 0.67 | 3.09 | 102.8 |
| 1-05 | 25.0 | 0.40 | 0.97 | 633.120 | 306 | 77 | 68 | 0.63 | 2.82 | 99.3 |
| 2-01 | 30.0 | 0.60 | 1.50 | 636.750 | 307 | 79 | 69 | 0.77 | 3.63 | 104.3 |
| 2-02 | 35.0 | 0.56 | 1.40 | 640.100 | 309 | 80 | 69 | 0.75 | 3.35 | 99.7 |
| 2-03 | 40.0 | 0.50 | 1.20 | 643.200 | 309 | 80 | 70 | 0.71 | 3.10 | 97.5 |
| 2-04 | 45.0 | 0.45 | 1.10 | 646.190 | 308 | 80 | 71 | 0.67 | 2.99 | 98.9 |
| 2-05 | 50.0 | 0.37 | 0.90 | 648.970 | 307 | 82 | 71 | 0.61 | 2.78 | 101.1 |
| 3-01 | 55.0 | 0.57 | 1.40 | 652.420 | 308 | 84 | 72 | 0.75 | 3.45 | 101.0 |
| 3-02 | 60.0 | 0.50 | 1.20 | 655.510 | 309 | 86 | 73 | 0.71 | 3.09 | 96.3 |
| 3-03 | 65.0 | 0.47 | 1.10 | 658.490 | 310 | 87 | 74 | 0.69 | 2.98 | 95.7 |
| 3-04 | 70.0 | 0.45 | 1.10 | 661.450 | 310 | 87 | 75 | 0.67 | 2.96 | 97.1 |
| 3-05 | 75.0 | 0.45 | 1.10 | 664.450 | 310 | 87 | 76 | 0.67 | 3.00 | 98.3 |
| 4-01 | 80.0 | 0.60 | 1.50 | 668.010 | 310 | 87 | 77 | 0.77 | 3.56 | 101.0 |
| 4-02 | 85.0 | 0.55 | 1.30 | 671.290 | 310 | 88 | 78 | 0.74 | 3.28 | 97.0 |
| 4-03 | 90.0 | 0.53 | 1.30 | 674.640 | 311 | 88 | 78 | 0.73 | 3.35 | 101.0 |
| 4-04 | 95.0 | 0.48 | 1.20 | 677.780 | 311 | 87 | 78 | 0.69 | 3.14 | 99.5 |
| 4-05 | 100.0 | 0.45 | 1.10 | 680.880 | 312 | 88 | 79 | 0.67 | 3.10 | 101.3 |
| 5-01 | 105.0 | 0.48 | 1.20 | 683.970 | 309 | 89 | 79 | 0.69 | 3.09 | 97.5 |
| 5-02 | 110.0 | 0.45 | 1.10 | 687.010 | 314 | 88 | 79 | 0.67 | 3.04 | 99.5 |
| 5-03 | 115.0 | 0.45 | 1.10 | 690.030 | 312 | 88 | 79 | 0.67 | 3.02 | 98.7 |
| 5-04 | 120.0 | 0.45 | 1.10 | 693.030 | 312 | 89 | 80 | 0.67 | 3.00 | 97.9 |
| 5-05 | 125.0 | 0.40 | 0.97 | 695.910 | 311 | 89 | 80 | 0.63 | 2.88 | 99.5 |
| Final | 125.0 | | 1.16760 | 77.74500 | 309.00000 | 78.44000 | | 0.68951 | 77.74500 | |
| 25 points sampled | | Sq.Rt.ΔP | | | | | | | | |
| QC-Check: Field Averages | | 0.6895 | 1.1676 | 77.7450 | 309.0000 | 78.4400 | | | | |
| | | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | ☑ Avg. OK | | | | |

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QA/QC _____
Date _____

## USEPA Method 4 Laboratory Data

Location: Unit 3 FF Outlet
Client: Wheelabrator North Broward, Inc.
Project No: 10955

Test Method: USEPA Method 29
Analyte: Trace Metals
Analyst: C. Slimp
Analyst Emp No: 558

Test Run: 1

| | Contents | Gross (gm) | Tare (gm) | Net (gm) |
|---|---|---|---|---|
| Impinger 1 | Empty | 607.7 | 415.7 | 192.0 |
| Impinger 2 | 5%HNO3/10%H2O2 | 685.5 | 545.3 | 140.2 |
| Impinger 3 | 5%HNO3/10%H2O2 | 590.9 | 545.5 | 45.4 |
| Impinger 4 | Empty | 462.8 | 450.8 | 12.0 |
| Impinger 5 | 4%KMnO4/10%H2SO4 | 542.6 | 537.6 | 5.0 |
| Impinger 6 | 4%KMnO4/10%H2SO4 | 566.7 | 565.9 | 0.8 |
| Impinger 7 | Silica Gel | 751.8 | 730.7 | 21.1 |
| Impinger 8 | | | | |

Rinse: (ml or gm)

| | | Field Data Check | |
|---|---|---|---|
| 395.4 | Liquid (gm) | | |
| 0.0 | less rinse (gm) | | |
| 395.4 | Net Liquid (gm) | 395.4 | ☑ QA/QC OK |
| + 21.1 | Silica Gel (gm) | 21.1 | ☑ QA/QC OK |
| 416.5 | Total Vlc (gm) | 416.5 | ☑ QA/QC OK |

Test Run: 2

| | Contents | Gross (gm) | Tare (gm) | Net (gm) |
|---|---|---|---|---|
| Impinger 1 | Empty | 606.4 | 428.8 | 177.6 |
| Impinger 2 | 5%HNO3/10%H2O2 | 730.5 | 621.1 | 109.4 |
| Impinger 3 | 5%HNO3/10%H2O2 | 589.0 | 536.3 | 52.7 |
| Impinger 4 | Empty | 478.4 | 456.1 | 22.3 |
| Impinger 5 | 4%KMnO4/10%H2SO4 | 554.4 | 545.8 | 8.6 |
| Impinger 6 | 4%KMnO4/10%H2SO4 | 540.0 | 538.1 | 1.9 |
| Impinger 7 | Silica Gel | 750.6 | 728.0 | 22.6 |
| Impinger 8 | | | | |

Rinse: (ml or gm)

| | | Field Data Check | |
|---|---|---|---|
| 372.5 | Liquid (gm) | | |
| 0.0 | less rinse (gm) | | |
| 372.5 | Net Liquid (gm) | 372.5 | ☑ QA/QC OK |
| + 22.6 | Silica Gel (gm) | 22.6 | ☑ QA/QC OK |
| 395.1 | Total Vlc (gm) | 395.1.1 | ☐ QA/QC OK |

Test Run: 3

| | Contents | Gross (gm) | Tare (gm) | Net (gm) |
|---|---|---|---|---|
| Impinger 1 | Empty | 695.6 | 419.2 | 276.4 |
| Impinger 2 | 5%HNO3/10%H2O2 | 629.5 | 546.7 | 82.8 |
| Impinger 3 | 5%HNO3/10%H2O2 | 563.3 | 548.5 | 14.8 |
| Impinger 4 | Empty | 455.3 | 452.9 | 2.4 |
| Impinger 5 | 4%KMnO4/10%H2SO4 | 541.9 | 541.7 | 0.2 |
| Impinger 6 | 4%KMnO4/10%H2SO4 | 547.9 | 548.3 | -0.4 |
| Impinger 7 | Silica Gel | 767.3 | 751.5 | 15.8 |
| Impinger 8 | | | | |

Rinse: (ml or gm)

| | | Field Data Check | |
|---|---|---|---|
| 376.2 | Liquid (gm) | | |
| 0.0 | less rinse (gm) | | |
| 376.2 | Net Liquid (gm) | 376.2 | ☑ QA/QC OK |
| + 15.8 | Silica Gel (gm) | 15.8 | ☑ QA/QC OK |
| 392.0 | Total Vlc (gm) | 392.0 | ☑ 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 |

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Date _____

## USEPA Method 3 Laboratory Data

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

Location: Unit 3 FF Outlet
Client: Wheelabrator North Broward, Inc.
Project No: 10955
Method: EPA Method 3
Fuel Type: Municipal Waste
$F_o$ for Fuel: 1.03 to 1.3

Analyst: C. Slimp
Analyst Emp No: 558

| 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 | 8.2 | 19.0 | 10.8 | 81.0 | 29.74 | | |
| | 2 | 8.2 | 19.0 | 10.8 | 81.0 | 29.74 | | |
| | 3 | 8.4 | 19.0 | 10.6 | 81.0 | 29.77 | | |
| | Avg. | 8.26667 | | 10.73333 | 81.00000 | 29.75 | 1.22984 | *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 | 8.2 | 19.0 | 10.8 | 81.0 | 29.74 | | |
| | 2 | 8.2 | 19.0 | 10.8 | 81.0 | 29.74 | | |
| | 3 | 8.2 | 18.8 | 10.6 | 81.2 | 29.74 | | |
| | Avg. | 8.20000 | | 10.73333 | 81.06667 | 29.74 | 1.23984 | *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 | 19.2 | 10.2 | 80.8 | 29.85 | | |
| | 2 | 8.8 | 19.0 | 10.2 | 81.0 | 29.82 | | |
| | 3 | 9.0 | 19.0 | 10.0 | 81.0 | 29.84 | | |
| | Avg. | 8.93333 | | 10.13333 | 80.93333 | 29.83 | 1.20522 | *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: |
|---|---|---|---|---|---|---|---|---|
| | 1 | | | | | | | |
| | 2 | | | | | | | |
| | 3 | | | | | | | |
| | Avg. | | | | | | | |
| CEM or Other Avg: | | | | | | | | ☐ Fo value within expected range. |

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Date _____

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## LABORATORY DATA

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Wheelabrator North Broward, Inc.
Clean Air Project No: 10955
Unit 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) | <0.2000 | | |
| $m_{3a-B}$ | Fraction 3A Blank (µg) | <0.2000 | | |
| $m_{3b-B}$ | Fraction 3B Blank (µg) | <0.5000 | | |
| $m_{3c-B}$ | Fraction 3C Blank (µg) | <0.4000 | | |
| $m_{total-B}$ | Total Blank Amount (µg) | <1.4000 | | |
| **Run No.** | | **1** | **2** | **3** |
| Date (2010) | | Dec 8 | Dec 8 | Dec 8 |
| Start Time (approx.) | | 08:04 | 10:45 | 13:10 |
| Stop Time (approx.) | | 10:19 | 12:53 | 15:15 |
| **Sample Analysis** | | | | |
| $m_{1b-S}$ | Fraction 1B Sample (µg) | <0.1000 | <0.1000 | <0.1000 |
| $m_{2b-S}$ | Fraction 2B Sample (µg) | 7.9536 | 7.4497 | 10.7533 |
| $m_{3a-S}$ | Fraction 3A Sample (µg) | <0.2000 | 0.3763 | <0.2000 |
| $m_{3b-S}$ | Fraction 3B Sample (µg) | <0.5000 | <0.5000 | <0.5000 |
| $m_{3c-S}$ | Fraction 3C Sample (µg) | <0.4000 | <0.4000 | <0.4000 |
| $m_{total-S}$ | Total Sample Amount (µg) | 7.9536 | 7.8260 | 10.7533 |
| **Allowable Blank** | | | | |
| $m_{T-B-allow}$ | Total Allowable Blank (µg) | 0.0000 | 0.0000 | 0.0000 |
| **Sample Corrected for Blank** | | | | |
| $m_n$ | Total Sample Amount (µg) | 7.9536 | 7.8260 | 10.7533 |
| **Sample Corrected for Blank** | | | | |
| $m_{n-1b}$ | Fraction 1B (µg) | <0.1000 | <0.1000 | <0.1000 |
| $m_{n-2b}$ | Fraction 2B (µg) | 7.9536 | 7.4497 | 10.7533 |
| $m_{n-3a}$ | Fraction 3A (µg) | <0.2000 | 0.3763 | <0.2000 |
| $m_{n-3b}$ | Fraction 3B (µg) | <0.5000 | <0.5000 | <0.5000 |
| $m_{n-3c}$ | Fraction 3C (µg) | <0.4000 | <0.4000 | <0.4000 |



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Date _____

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# Clean Air Engineering, Inc.

500 West Wood Street
Palatine, IL 60067

Project Number: 10955

Mercury

EPA Method 29 Analysis

Analytical Report
15849

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

The following data for Analytical Report 15849
has been reviewed for completeness, accuracy,
adherence to method protocol,
and compliance with quality assurance guidelines.

Review by:

Daphne Woodman, Chemist
December 21, 2010

Report Reviewed and Finalized By:

Ken Smith, Laboratory Director
December 21, 2010

# SUMMARY OF RESULTS

## Summary of Analysis

### Summary of Method 29 Mercury Analysis

| Run Number | | Average Total Catch, µg | Front half µg | $H_2O_2$ /$HNO_3$ µg | Empty Impinger µg | $KMnO_4$ µg | HCl µg |
|---|---|---|---|---|---|---|---|
| U3 FF Outlet R1 | #1 | 7.95 | < 0.1 | 8.07 | < 0.2 | < 0.5 | < 0.4 |
| | #2 | | < 0.1 | 7.83 | < 0.2 | < 0.5 | < 0.4 |
| U3 FF Outlet R2 | #1 | 7.83 | < 0.1 | 7.62 | 0.389 | < 0.5 | < 0.4 |
| | #2 | | < 0.1 | 7.28 | 0.363 | < 0.5 | < 0.4 |
| U3 FF Outlet R3 | #1 | 10.8 | < 0.1 | 11.0 | < 0.2 | < 0.5 | < 0.4 |
| | #2 | | < 0.1 | 10.5 | < 0.2 | < 0.5 | < 0.4 |
| Field Blank | #1 | < 0.5 | < 0.1 | < 0.3 | < 0.2 | < 0.5 | < 0.4 |
| | #2 | | < 0.1 | < 0.3 | < 0.2 | < 0.5 | < 0.4 |
| Reagent Blank | #1 | < 0.5 | < 0.1 | < 0.2 | < 0.2 | < 0.5 | < 0.4 |
| | #2 | | < 0.1 | < 0.2 | < 0.2 | < 0.5 | < 0.4 |

# ANALYTICAL NARRATIVE

## Element One Analytical Narrative

| | | | |
|---|---|---|---|
| Client: | Clean Air, IL | Element One #: | 15849 |
| Client ID: | 10955/N. Broward | Analyst: | DV & VA |
| Method: | Methods 29 | Dates Received: | 12/09/10 |
| Analytes: | Hg | Dates Analyzed: | 12/10-20/10 |

### Summary of Analysis

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

### Detection Limits

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

### Analysis QA/QC

Duplicate analyses relative percent difference (RPD) and spike sample recovery data are summarized in the Quality Control Section. All QA/QC data was within the criteria of the method.

### Additional Comments

The reported results have not been corrected for any blank values or spike recovery values.

# QUALITY CONTROL SUMMARY

## Summary of Quality Control Data

### Mercury Duplicate Analysis RPD

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

| Run Number | Front half | $H_2O_2/HNO_3$ | Empty Imp | $KMnO_4$ | HCl |
|---|---|---|---|---|---|
| U3 FF Outlet R1 | NA | 3.0% | NA | NA | NA |
| U3 FF Outlet R2 | NA | 4.5% | 7.0% | NA | NA |
| U3 FF Outlet R3 | NA | 4.8% | NA | NA | NA |
| Field Blank | NA | NA | NA | NA | NA |
| Reagent Blank | NA | NA | NA | NA | NA |

### Mercury Spike Recoveries

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

| Run Number | | Front half | H2O2/HNO4 | Empty Imp | KMnO4 | HCl |
|---|---|---|---|---|---|---|
| U3 FF Outlet R3 | #1 | 115% | 106% | 117% | 112% | 105% |
| | #2 | 113% | 110% | 109% | 113% | 94% |

# SAMPLE CUSTODY

# CHAIN OF CUSTODY FORM

15849 201623

CLIENT: Wheelabrator | PROJECT NO. 10955 | PAGE 1 OF 3
PLANT: N. Broward | DEPT. 66 | REVISION NO. 1
PROJECT MANAGER: S. Brown | RECOVERY PERSON: C. Slimp
JOB LEADER: C. Slimp

| CAE LAB NO. | RUN NO. | TEST LOCATION | DATE | SAMPLE MATRIX | NO. OF CONTAINERS | ORIGINAL VOLUME | H2O | ANALYSIS REQUESTED | ADDITIONAL INFORMATION |
|---|---|---|---|---|---|---|---|---|---|
| | Blank | Lab | 12/8 | Quartz Filter Blank | 1 | N/A | ✓ | | |
| | Field Blank | Unit 3 FF Outlet | 12/8 | ~~Quartz Filter Field Quartz~~ | 1 | " | ✓ | | |
| | 1 | " | 12/8 | Quartz Filter | 1 | " | ✓ | | |
| | 2 | " | 12/8 | " | 1 | " | ✓ | | |
| | 3 | " | 12/8 | " | 1 | " | ✓ | | |
| | | | | | | | | | |
| | Blank | ~~Lab~~ Unit 3 FF Outlet | 12/8 | 8N HCl Rinse of Imp 5+6 | 1 | 225 | ✓ | | |
| | Field Blank | " | 12/8 | " | | 225 | ✓ | | |
| | 1 | " | 12/8 | " | | 225 | ✓ | | |
| | 2 | " | 12/8 | " | | 225 | ✓ | | |
| | 3 | " | 12/8 | " | | 225 | ✓ | | |
| | | | | | | | | | |
| | Reagent Blank | Lab | 12/8 | DI water | 1 | 100 | ✓ | | |
| | | | | | | | | | |
| | | | | | | | | | |

| Relinquished by:(Signature) | Date/Time | Received by:(Signature) | Date/Time | Relinquished by:(Signature) | Date/Time |
|---|---|---|---|---|---|
| Carl Slimp | 12/8/10 | | | | |
| Courier: | Date/Time | Relinquished by:(Signature) | Date/Time | Rec'd for Analysis by: | Date/Time |
| | | | | Lisa Bratton | 12/9/10 1010 |

Special Handling Instructions: Attn: Ken Smith

Forwarding Lab: Element One
5022-C Wrightsville Ave
Wilmington, NC 28405

PO Number:

This form was completed by: Carl Slimp

| Signature | Date |
|---|---|
| Carl Slimp | 12/8/10 |

Samples received in good condition in Fisherbrand coolers.
No empty container received.

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

DS COC Palatine
EXCLR0-8/7/06

# CHAIN OF CUSTODY FORM

15849 201487

CLIENT Wheelabrator
PLANT N. Broward
PROJECT MANAGER G. Brown
JOB LEADER C. Slimp
PROJECT NO. 10955
DEPT. 66
RECOVERY PERSON: Carl Slimp

PAGE 2 OF 3
REVISION NO. 1

| CAE LAB NO. | RUN NO. | TEST LOCATION | DATE | SAMPLE MATRIX | NO. OF CONTAINERS | ORIGINAL VOLUME | Hg | ANALYSIS REQUESTED | | | ADDITIONAL INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Blank | Lab | 12/8/10 | 5% $HNO_3$/10% $H_2O_2$ Blank | 1 | 200 | ✓ | | | | |
| | Field Blank | ~~Train~~ FF Outlet U3 | 11 | Impl-3 catch+rinse | 1 | 300 | ✓ | | | | |
| | 1 | 11 | 11 | 11 | 1 | 667 | ✓ | | | | |
| | 2 | 11 | 11 | 11 | 1 | 614 | ✓ | | | | |
| | 3 | 11 | 11 | 11 | 1 | 427 | ✓ | | | | |
| | | | | | | | | | | | |
| | Blank | Lab | 12/8/10 | 0.1N $HNO_3$ | 1 | 300 | ✓ | | | | |
| | Field Blank | FF Outlet | 11 | Imp 4 catch+rinse | 1 | 100 | ✓ | | | | |
| | 1 | 11 | 11 | 11 | 1 | 110 | ✓ | | | | |
| | 2 | 11 | 11 | 11 | 1 | 117 | ✓ | | | | |
| | 3 | 11 | 11 | 11 | 1 | 108 | ✓ | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| Relinquished by:(Signature) | Date/Time | Received by:(Signature) | Date/Time | Relinquished by:(Signature) | Date/Time |
|---|---|---|---|---|---|
| Carl Slimp | 12/8/10 | | | | |
| **Courier:** | **Date/Time** | **Relinquished by:(Signature)** | **Date/Time** | **Rec'd for Analysis by:** | **Date/Time** |
| | | | | Lisa Bratton | 12/9/10 1010 |

Special Handling Instructions: Attn: Ken Smith

Forwarding Lab: Elementent One
5022-C Wrightsville Ave
Wilmington, NC 28405

PO Number:

This form was completed by: Carl Slimp

| Signature | Date |
|---|---|
| Carl Slimp | 12/8/10 |

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

DS COC Palatine
EXCL.RD-6/7/98

# CHAIN OF CUSTODY FORM

15849 201486

CLIENT Wheelabrator | PROJECT NO. 10955 | PAGE 3 OF 3
PLANT North Brunswick | DEPT. 66 | REVISION NO. 1
PROJECT MANAGER Scott Brown | RECOVERY PERSON:
JOB LEADER Carl Slimp | Carl Slimp

| CAE LAB NO. | RUN NO. | TEST LOCATION | DATE | SAMPLE MATRIX | NO. OF CONTAINERS | ORIGINAL VOLUME | Hg | ANALYSIS REQUESTED | ADDITIONAL INFORMATION |
|---|---|---|---|---|---|---|---|---|---|
| | Blank | Lab | 12/8 | 4% $KMnO_4$/10% $H_2SO_4$ Blank | 1 | 100 | ✓ | | |
| | Field Blank | FF Outlet U3 | 12/8/10 | Imp Catch + S+6 | 1 | 460 | ✓ | | |
| | 1 | " | " | Imp S+6 Catch + Rinse | 1 | 420 | ✓ | | |
| | 2 | " | " | " | 1 | 420 | ✓ | | |
| | 3 | " | " | " | 1 | 563 | | | |
| | Field Blank | FF Outlet U3 | 12/8/10 | F½ Rinse 0.1 Nitric | 1 | 100 | ✓ | | |
| | 1 | | " | | 1 | 100 | ✓ | | |
| | 2 | | " | | 1 | 100 | ✓ | | |
| | 3 | | " | | 1 | 100 | ✓ | | |

| Relinquished by:(Signature) | Date/Time | Received by:(Signature) | Date/Time | Relinquished by:(Signature) | Date/Time |
|---|---|---|---|---|---|
| Carl Slimp | 12/8 | | | | |
| Courier: | Date/Time | Relinquished by:(Signature) | Date/Time | Rec'd for Analysis by: Lisa Bratton | Date/Time 12/9/10 1010 |

Special Handling Instructions: Attn: Ken Smith

Forwarding Lab: Element One
5022-C Wrightsville Ave
Wilmington, NC 28405

PO Number:

This form was completed by: Carl Slimp

| Signature | Date |
|---|---|
| Carl Slimp | 12/8/10 |

Clean Air Engineering
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800-627-0033 Fax (847) 991-3385

D3 COC Palatine
EXCL_R0-6/7/99

# ANALYTICAL DATA

## Analytical Calculations

**Mercury-**

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

**Where-**

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

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

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

## Analytical Calculations

**Spike Recovery-**

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

**Where-**

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

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

Spike Amount--*ICP-MS Spike Table*

**Duplicate Analysis RPD-**

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

**Where-**

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

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

elementOne **AIR TESTING SAMPLE SUBMISSION FORM** **Lab ID 15849**

Analysis Due Date 12.16.10
QA/QC/Report Due Date 12.20.10

| | |
|---|---|
| Client | Clean Air IL |
| Project No | 10955 |

| | |
|---|---|
| Date Rec | 12.09.10 |
| Time Rec | 1010 |

| | | | |
|---|---|---|---|
| $HNO_3$ Lot: 1110620 | HF Lot: 5109120 | HCl Lot: 4110000 | **Ref. Method: 29** |
| Volume Marked (Y) N | Volume Loss Y / (N) ? | | |

**Sample Identification**

| | | | | | |
|---|---|---|---|---|---|
| 1 | U3 FF Outlet R1 | 4 | Field Blank | | |
| 2 | U3 FF Outlet R2 | 5 | Reagent Blank | | |
| | U3 FF Outlet R2 Duplicate | | | | |
| 3 | U3 FF Outlet R3 | | | | |
| | U3 FF Outlet R3 Spike | | | | |

**Analyses Requested** Samples 1-5 Hg

| Runs / FB | Fil / Ace (FH) | | $HNO_3$ (FH) | | 5% $HNO_3$/10% $H_2O_2$ (BH) | | | $HNO_3$ (A) | | $KMnO_4$ (B) | | HCl (C) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pH <2.0 Y / N | | pH <2.0 (Y) N | | pH <2.0 (Y) N | | | pH <2.0 (Y) N | | pH <2.0 (Y) N | | pH <2.0 Y / N | |
| Lab ID | Fil ID | BV ml | BV ml | FV ml | BV ml | Used | FV ml | BV ml | FV ml | BV ml | FV ml | BV ml | FV ml |
| 1 | | | 100 | 100 | 6160 | | | 114 | 200 | 390 | 500 | ~~220~~ 230 | 400 |
| 2.D | | | 100 | ↓ | 6050 | | | 116 | ↓ | 370 | ↓ | 230 | ↓ |
| 3.S | | | 100 | | 6160 | | | 106 | | 390 | | 230 | |
| 4 | | | 100 | | 290 | | | 102 | | 380 | | 230 | |

**M-29 Reagent Blank**

| Lab ID | | | Fraction | BV, ml | FV, ml | Comments |
|---|---|---|---|---|---|---|
| 5 | C-7 | FH | Acetone Blank | | | * 90 mL C10 was combined |
| | C-8A | FH | 0.1N $HNO_3$ | 300 | | with 30 mL C8B for a |
| | C-8A | A | 0.1N $HNO_3$ | ↓ | | B Fraction for a final |
| | C-8B | B | DI $H_2O$ | 100 | | volume of 120mL |
| | C-9 | BH | 5% $HNO_3$/10% $H_2O_2$ | 190 | | |
| | C-10 | B | 4% $KMnO_4$/10%$H_2SO_4$ | 90 | | * used 100 mL C8A for |
| | C-11 | C | 8N HCl DI $H_2O$ | 230 | 400 | Front half |
| | C-12 | FH | Filter | | | |

**Lab Communications**

FH spiked w/ 200 µL Standard A

Fractions Received c1, c3, c4, c5a, c5b, c5c; c12, c8a, c8b, c9, c10, c11—LLB 12.09.10

SS Page1 of 1
12/10/2010 9:04:13 AM
SS by LLB
Labeled By/Date DRJ 12/10/10

FH Prep By/Date VA 12.13.10
BH Prep By/Date ↓
BH/FH Prep By/Date ↓
PM Prep By / Date

A Prep By/Date VA 12.10.10
B Prep By/Date ↓
C Prep By/Date VA 12.13.10
ID Verification By/Date VA 12.10.10

PerkinElmer FIMS-100 CVAA Mercury Analyzer

| Sample_ID | Date | Time | Mean_Sig | Mean_Rd | Mean_Rt | Units | Alq. | Vol. | Sig 1 | Reading-1 | Result-1 | Sig 2 | Reading-2 | Result-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calib Blank | 12/10/2010 | 12:30:11 | 0.0002146 | | | µg | | | 0.0002146 | | | | | |
| STD1=.004ug | 12/10/2010 | 12:31:25 | 0.001118 | | | µg | | | 0.001118 | | | | | |
| STD2=.04ug | 12/10/2010 | 12:32:40 | 0.0092747 | | | µg | | | 0.0092747 | | | | | |
| STD3=.08ug | 12/10/2010 | 12:33:56 | 0.0198845 | | | µg | | | 0.0198845 | | | | | |
| STD4=.16ug | 12/10/2010 | 12:35:12 | 0.0410735 | | | µg | | | 0.0410735 | | | | | |
| STD5=.2ug | 12/10/2010 | 12:36:30 | 0.0523793 | | | µg | | | 0.0523793 | | | | | |
| 0.004ug = DL | 12/10/2010 | 12:41:42 | 0.0009683 | 0.0037474 | 0.0037474 | µg | | | 0.0009683 | 0.0037474 | 0.0037474 | | | |
| 0.080ug = STD.2 | 12/10/2010 | 12:42:57 | 0.0209365 | 0.0810216 | 0.0810216 | µg | | | 0.0209365 | 0.0810216 | 0.0810216 | | | |
| 0.080ug = QC STD 3 | 12/10/2010 | 12:49:27 | 0.0209373 | 0.0810249 | 0.0810249 | µg | | | 0.0209373 | 0.0810249 | 0.0810249 | | | |
| 0.004ug = DL | 12/10/2010 | 14:32:03 | 0.0010445 | 0.004042 | 0.004042 | µg | 4 | 700 | 0.0010445 | 0.004042 | 0.004042 | | | |
| 0.080ug = STD.2 | 12/10/2010 | 14:33:19 | 0.0217337 | 0.0841066 | 0.0841066 | µg | 4 | 700 | 0.0217337 | 0.0841066 | 0.0841066 | | | |
| 0.080ug = QC STD 3 | 12/10/2010 | 14:34:38 | 0.0208825 | 0.0808129 | 0.0808129 | µg | 4 | 700 | 0.0208825 | 0.0808129 | 0.0808129 | | | |
| REAGENT BLANK | 12/10/2010 | 14:35:54 | 0.0001086 | 0.0004201 | 0.0004201 | µg | 4 | 700 | 0.0001086 | 0.0004201 | 0.0004201 | | | |
| 15849-1A | 12/10/2010 | 14:39:22 | 0.0002764 | 0.0010698 | 0.0534907 | µg | 4 | 200 | 0.0002644 | 0.0010231 | 0.0511569 | 0.0002885 | 0.0011165 | 0.0558244 |
| 15849-2A dup | 12/10/2010 | 14:42:51 | 0.0019449 | 0.0075266 | 0.3763293 | µg | 4 | 200 | 0.0020129 | 0.0077898 | 0.3894887 | 0.0018769 | 0.0072634 | 0.3631698 |
| 15849-3A | 12/10/2010 | 14:44:37 | 0.0000423 | 0.0001637 | 0.0081859 | µg | 4 | 200 | 0.000113 | 0.0004374 | 0.0218707 | -0.0000284 | -0.0001099 | -0.0054989 |
| 15849-3A spk | 12/10/2010 | 14:46:23 | 0.0233455 | 0.0903444 | 4.5172211 | µg | 4 | 200 | 0.0242384 | 0.0937998 | 4.6899911 | 0.0224526 | 0.086889 | 4.344451 |
| 15849-4A | 12/10/2010 | 14:48:09 | -0.0000335 | -0.0001298 | -0.0064905 | µg | 4 | 200 | -0.000045 | -0.0001741 | -0.0087095 | -0.000022 | -0.0000854 | -0.0042715 |
| 15849-5A | 12/10/2010 | 14:49:55 | 0.0004348 | 0.0016825 | 0.0841267 | µg | 4 | 200 | 0.0004518 | 0.0017485 | 0.087425 | 0.0004177 | 0.0016166 | 0.0808283 |
| 0.004ug = DL | 12/10/2010 | 14:57:12 | 0.0009776 | 0.0037831 | 0.0037831 | µg | 4 | 200 | 0.0009776 | 0.0037831 | 0.0037831 | | | |
| 0.080ug = STD.2 | 12/10/2010 | 14:58:28 | 0.0198944 | 0.0769888 | 0.0769888 | µg | 4 | 200 | 0.0198944 | 0.0769888 | 0.0769888 | | | |
| REAGENT BLANK | 12/10/2010 | 14:59:44 | 6.25E-06 | 2.421E-05 | 2.421E-05 | µg | 4 | 200 | 6.25E-06 | 2.421E-05 | 2.421E-05 | | | |
| Calib Blank | 12/13/2010 | 12:21:50 | 0.0002463 | | | µg | | | 0.0002463 | | | | | |
| STD1=.004ug | 12/13/2010 | 12:23:04 | 0.0009525 | | | µg | | | 0.0009525 | | | | | |
| STD2=.04ug | 12/13/2010 | 12:24:18 | 0.0079609 | | | µg | | | 0.0079609 | | | | | |
| STD3=.08ug | 12/13/2010 | 12:25:34 | 0.0191992 | | | µg | | | 0.0191992 | | | | | |
| STD4=.16ug | 12/13/2010 | 12:27:01 | 0.0369654 | | | µg | | | 0.0369654 | | | | | |
| STD5=.2ug | 12/13/2010 | 12:28:19 | 0.0430846 | | | µg | | | 0.0430846 | | | | | |
| 0.004ug = DL | 12/13/2010 | 12:32:32 | 0.0009078 | 0.0040702 | 0.0040702 | µg | | | 0.0009078 | 0.0040702 | 0.0040702 | | | |
| 0.080ug = STD.2 | 12/13/2010 | 12:35:07 | 0.0191727 | 0.0859587 | 0.0859587 | µg | | | 0.0191727 | 0.0859587 | 0.0859587 | | | |
| 0.080ug = QC STD 3 | 12/13/2010 | 12:37:45 | 0.0182755 | 0.0819364 | 0.0819364 | µg | | | 0.0182755 | 0.0819364 | 0.0819364 | | | |
| 15849-1 B | 12/13/2010 | 12:55:38 | 0.000289 | 0.0012956 | 0.1619555 | µg | 4 | 500 | 0.0002977 | 0.0013346 | 0.1668194 | 0.0002803 | 0.0012567 | 0.1570917 |
| 15849-2 B | 12/13/2010 | 12:57:25 | 0.0005996 | 0.0026884 | 0.3360487 | µg | 4 | 500 | 0.0006339 | 0.002842 | 0.3552527 | 0.0005654 | 0.0025348 | 0.3168447 |
| 15849-2 B dup | 12/13/2010 | 12:59:08 | 0.0004368 | 0.0019582 | 0.2447754 | µg | 4 | 500 | 0.0004226 | 0.0018949 | 0.2368604 | 0.0004509 | 0.0020215 | 0.2526903 |
| 0.004ug = DL | 12/13/2010 | 13:00:21 | 0.0008418 | 0.0037742 | 0.0037742 | µg | 4 | 500 | 0.0008418 | 0.0037742 | 0.0037742 | | | |
| 0.080ug = STD.2 | 12/13/2010 | 13:01:37 | 0.0190526 | 0.0854203 | 0.0854203 | µg | 4 | 500 | 0.0190526 | 0.0854203 | 0.0854203 | | | |
| REAGENT BLANK | 12/13/2010 | 13:02:53 | 0.0004255 | 0.0019076 | 0.0019076 | µg | 4 | 500 | 0.0004255 | 0.0019076 | 0.0019076 | | | |
| 15849-3 B | 12/13/2010 | 13:04:37 | 0.0001981 | 0.0008882 | 0.1110301 | µg | 4 | 500 | 0.0002143 | 0.0009606 | 0.1200713 | 0.000182 | 0.0008159 | 0.1019888 |
| 15849-3 B spk | 12/13/2010 | 13:06:21 | 0.0200971 | 0.0901032 | 11.262899 | µg | 4 | 500 | 0.0200533 | 0.0899067 | 11.238337 | 0.0201409 | 0.0902997 | 11.287461 |
| 15849-4 B | 12/13/2010 | 13:08:05 | 0.0003328 | 0.001492 | 0.1865051 | µg | 4 | 500 | 0.0003297 | 0.0014781 | 0.1847606 | 0.0003359 | 0.001506 | 0.1882496 |
| 15849-5 B | 12/13/2010 | 13:09:50 | 0.0002188 | 0.0009811 | 0.1226428 | µg | 4 | 500 | 0.0002253 | 0.00101 | 0.1262523 | 0.0002124 | 0.0009523 | 0.1190333 |
| 15849-2 A | 12/13/2010 | 13:11:36 | 0.001816 | 0.0081417 | 0.4070866 | µg | 4 | 200 | 0.001853 | 0.0083076 | 0.4153822 | 0.001779 | 0.0079758 | 0.398791 |
| 0.004ug = DL | 12/13/2010 | 13:14:36 | 0.0008001 | 0.0035873 | 0.0035873 | µg | 4 | 200 | 0.0008001 | 0.0035873 | 0.0035873 | | | |
| 0.080ug = QC STD 3 | 12/13/2010 | 13:15:52 | 0.0194171 | 0.0870548 | 0.0870548 | µg | 4 | 200 | 0.0194171 | 0.0870548 | 0.0870548 | | | |
| REAGENT BLANK | 12/13/2010 | 13:17:08 | 0.0004522 | 0.0020276 | 0.0020276 | µg | 4 | 200 | 0.0004522 | 0.0020276 | 0.0020276 | | | |
| Calib Blank | 12/14/2010 | 9:40:26 | 0.000304 | | | µg | | | 0.000304 | | | | | |
| STD1=.004ug | 12/14/2010 | 9:41:40 | 0.0011049 | | | µg | | | 0.0011049 | | | | | |
| STD2=.04ug | 12/14/2010 | 9:42:55 | 0.0075728 | | | µg | | | 0.0075728 | | | | | |
| STD3=.08ug | 12/14/2010 | 9:44:11 | 0.0168817 | | | µg | | | 0.0168817 | | | | | |
| STD4=.16ug | 12/14/2010 | 9:45:32 | 0.0318817 | | | µg | | | 0.0318817 | | | | | |
| STD5=.2ug | 12/14/2010 | 9:46:50 | 0.039229 | | | µg | | | 0.039229 | | | | | |
| 0.004ug = DL | 12/14/2010 | 9:51:03 | 0.0008498 | 0.0042813 | 0.0042813 | µg | | | 0.0008498 | 0.0042813 | 0.0042813 | | | |
| 0.080ug = STD.2 | 12/14/2010 | 9:53:38 | 0.0164935 | 0.083094 | 0.083094 | µg | | | 0.0164935 | 0.083094 | 0.083094 | | | |
| 0.080ug = QC STD 3 | 12/14/2010 | 9:56:16 | 0.0150247 | 0.0756943 | 0.0756943 | µg | | | 0.0150247 | 0.0756943 | 0.0756943 | | | |
| 0.004ug = DL | 12/14/2010 | 11:10:55 | 0.0008064 | 0.0040627 | 0.0040627 | µg | 4 | 600 | 0.0008064 | 0.0040627 | 0.0040627 | | | |
| 0.080ug = STD.2 | 12/14/2010 | 11:12:13 | 0.0160493 | 0.0808562 | 0.0808562 | µg | 4 | 600 | 0.0160493 | 0.0808562 | 0.0808562 | | | |
| REAGENT BLANK | 12/14/2010 | 11:13:29 | 4.885E-05 | 0.0002461 | 0.0002461 | µg | 4 | 600 | 4.885E-05 | 0.0002461 | 0.0002461 | | | |
| 15849 LRB | 12/14/2010 | 11:17:00 | 0.0002916 | 0.001469 | 0.0367239 | µg | 4 | 100 | 0.0003165 | 0.0015946 | 0.0398658 | 0.0002666 | 0.0013433 | 0.033582 |
| 15849 LRB spk | 12/14/2010 | 11:21:54 | 0.0124498 | 0.0627221 | 3.9201285 | µg | 1.6 | 100 | 0.0125401 | 0.0631771 | 3.9485673 | 0.0123595 | 0.062267 | 3.8916897 |
| 15849-1 FH | 12/14/2010 | 11:23:41 | 0.0001428 | 0.0007192 | 0.0179809 | µg | 4 | 100 | 0.0001713 | 0.0008629 | 0.0215725 | 0.0001142 | 0.0005756 | 0.0143892 |
| 15849-2 FH | 12/14/2010 | 11:25:28 | 0.0001483 | 0.0007471 | 0.0186767 | µg | 4 | 100 | 0.0001668 | 0.0008404 | 0.0210104 | 0.0001298 | 0.0006537 | 0.0163429 |
| 15849-2 FH dup | 12/14/2010 | 11:27:16 | 0.0002115 | 0.0010657 | 0.0266429 | µg | 4 | 100 | 0.000176 | 0.0008866 | 0.022164 | 0.0002471 | 0.0012449 | 0.0311217 |
| 15849-3 FH | 12/14/2010 | 11:29:05 | 0.0001966 | 0.0009904 | 0.0247605 | µg | 4 | 100 | 0.0002208 | 0.0011123 | 0.0278073 | 0.0001724 | 0.0008685 | 0.0217137 |
| 15849-3 FH spk | 12/14/2010 | 11:30:54 | 0.0180781 | 0.0910776 | 2.2769398 | µg | 4 | 100 | 0.018204 | 0.0917117 | 2.2927918 | 0.0179523 | 0.0904435 | 2.2610878 |
| 15849-4 FH | 12/14/2010 | 11:32:43 | 0.0002822 | 0.0014216 | 0.0355405 | µg | 4 | 100 | 0.0002919 | 0.0014705 | 0.036762 | 0.0002725 | 0.0013728 | 0.0343191 |
| 15849-5 FH | 12/14/2010 | 11:34:29 | 6.491E-05 | 0.000327 | 0.0081762 | µg | 4 | 100 | 0.0001151 | 0.0005801 | 0.0145025 | 1.468E-05 | 7.399E-05 | 0.0018499 |
| 0.004ug = DL | 12/14/2010 | 11:35:41 | 0.0008285 | 0.0041738 | 0.0041738 | µg | 4 | 100 | 0.0008285 | 0.0041738 | 0.0041738 | | | |
| 0.080ug = STD.2 | 12/14/2010 | 11:36:57 | 0.0161724 | 0.0814766 | 0.0814766 | µg | 4 | 100 | 0.0161724 | 0.0814766 | 0.0814766 | | | |
| REAGENT BLANK | 12/14/2010 | 11:38:13 | -0.0000503 | -0.0002534 | -0.0002534 | µg | 4 | 100 | -0.0000503 | -0.0002534 | -0.0002534 | | | |
| 15849-3 BH | 12/14/2010 | 11:45:07 | 0.012936 | 0.0651717 | 10.753337 | µg | 4 | 660 | 0.0132497 | 0.0667519 | 11.014065 | 0.0126224 | 0.0635916 | 10.49261 |
| 15849-3 BH spk | 12/14/2010 | 11:46:50 | 0.0300214 | 0.1512475 | 24.95584 | µg | 4 | 660 | 0.0297129 | 0.1496934 | 24.699404 | 0.0303298 | 0.1528017 | 25.212276 |
| 15849-4 BH | 12/14/2010 | 11:48:34 | 0.0002104 | 0.00106 | 0.0768517 | µg | 4 | 290 | 0.0001884 | 0.0009493 | 0.0688221 | 0.0002324 | 0.0011708 | 0.0848813 |
| 15849-5 BH | 12/14/2010 | 11:50:18 | 9.503E-05 | 0.0004788 | 0.0227419 | µg | 4 | 190 | 0.0001015 | 0.0005111 | 0.0242788 | 8.881E-05 | 0.0004464 | 0.021205 |
| 0.004ug = DL | 12/14/2010 | 11:52:45 | 0.0007903 | 0.0039816 | 0.0039816 | µg | 4 | 190 | 0.0007903 | 0.0039816 | 0.0039816 | | | |
| 0.080ug = QC STD 3 | 12/14/2010 | 11:54:01 | 0.0152521 | 0.07684 | 0.07684 | µg | 4 | 190 | 0.0152521 | 0.07684 | 0.07684 | | | |
| REAGENT BLANK | 12/14/2010 | 11:55:17 | 2.067E-05 | 0.0001042 | 0.0001042 | µg | 4 | 190 | 2.067E-05 | 0.0001042 | 0.0001042 | | | |
| Calib Blank | 12/14/2010 | 16:29:48 | 9.901E-05 | | | µg | 0.4 | 600 | 9.901E-05 | | | | | |
| STD1=.004ug | 12/14/2010 | 16:31:02 | 0.001142 | | | µg | 0.4 | 600 | 0.001142 | | | | | |

PerkinElmer FIMS-100 CVAA Mercury Analyzer

| Sample_ID | Date | Time | Mean_Sig | Mean_Rd | Mean_Rt | Units | Alq. | Vol. | Sig 1 | Reading-1 | Result-1 | Sig 2 | Reading-2 | Result-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STD2=.04ug | 12/14/2010 | 16:32:16 | 0.0086581 | | | µg | 0.4 | 600 | 0.0086581 | | | | | |
| STD3=.08ug | 12/14/2010 | 16:33:33 | 0.0178971 | | | µg | 0.4 | 600 | 0.0178971 | | | | | |
| STD4=.16ug | 12/14/2010 | 16:34:49 | 0.0370032 | | | µg | 0.4 | 600 | 0.0370032 | | | | | |
| STD5=.2ug | 12/14/2010 | 16:36:07 | 0.0437011 | | | µg | 0.4 | 600 | 0.0437011 | | | | | |
| Reagent Blank | 12/14/2010 | 16:37:53 | 9.942E-05 | 0.0004448 | 0.0004448 | µg | 0.4 | 600 | 0.000134 | 0.0005993 | 0.0005993 | 6.488E-05 | 0.0002903 | 0.0002903 |
| 0.004ug = DL | 12/14/2010 | 16:41:32 | 0.0009244 | 0.0041354 | 0.0041354 | µg | 0.4 | 600 | 0.0009244 | 0.0041354 | 0.0041354 | | | |
| 0.080ug = STD.2 | 12/14/2010 | 16:45:19 | 0.0187923 | 0.0840704 | 0.0840704 | µg | 0.4 | 600 | 0.0187923 | 0.0840704 | 0.0840704 | | | |
| REAGENT BLANK | 12/14/2010 | 16:46:35 | 0.0001596 | 0.0007141 | 0.0007141 | µg | 0.4 | 600 | 0.0001596 | 0.0007141 | 0.0007141 | | | |
| 15849 FH LRB | 12/14/2010 | 16:48:19 | 3.738E-05 | 0.0001672 | 0.0041807 | µg | 4 | 100 | 2.631E-05 | 0.0001177 | 0.0029428 | 4.844E-05 | 0.0002167 | 0.0054186 |
| 15849 FH LRB spk | 12/14/2010 | 16:50:03 | 0.0168969 | 0.075591 | 4.7244395 | µg | 1.6 | 100 | 0.0171099 | 0.0765441 | 4.7840051 | 0.0166838 | 0.074638 | 4.664874 |
| 15849-2 BH | 12/14/2010 | 16:51:48 | 0.0102476 | 0.0458442 | 7.4496796 | µg | 4 | 650 | 0.0104785 | 0.0468772 | 7.6175446 | 0.0100167 | 0.0448112 | 7.2818146 |
| 15849-2 BH dup | 12/14/2010 | 16:53:34 | 0.0094529 | 0.0422892 | 6.8719911 | µg | 4 | 650 | 0.0097189 | 0.043479 | 7.0853364 | 0.009187 | 0.0410994 | 6.6786459 |
| 0.004ug = DL | 12/14/2010 | 17:06:57 | 0.0008647 | 0.0038683 | 0.0038683 | µg | 0.4 | 600 | 0.0008647 | 0.0038683 | 0.0038683 | | | |
| 0.080ug = STD.2 | 12/14/2010 | 17:08:12 | 0.0177241 | 0.0792917 | 0.0792917 | µg | 0.4 | 600 | 0.0177241 | 0.0792917 | 0.0792917 | | | |
| REAGENT BLANK | 12/14/2010 | 17:09:28 | 0.0003261 | 0.0014589 | 0.0014589 | µg | 0.4 | 600 | 0.0003261 | 0.0014589 | 0.0014589 | | | |
| 15849-1 BH | 12/14/2010 | 17:14:40 | 0.010775 | 0.0482036 | 7.9535941 | µg | 4 | 660 | 0.010937 | 0.0489283 | 8.0731772 | 0.010613 | 0.0474789 | 7.834011 |
| 0.004ug = DL | 12/14/2010 | 17:15:54 | 0.00095 | 0.0042502 | 0.0042502 | µg | 4 | 660 | 0.00095 | 0.0042502 | 0.0042502 | | | |
| 0.080ug = QC STD 3 | 12/14/2010 | 17:17:11 | 0.0166195 | 0.0743502 | 0.0743502 | µg | 4 | 660 | 0.0166195 | 0.0743502 | 0.0743502 | | | |
| REAGENT BLANK | 12/14/2010 | 17:18:27 | 0.0003336 | 0.0014925 | 0.0014925 | µg | 4 | 660 | 0.0003336 | 0.0014925 | 0.0014925 | | | |
| Calib Blank | 12/15/2010 | 12:29:11 | 0.0001099 | | | µg | | | 0.0001099 | | | | | |
| STD1=.004ug | 12/15/2010 | 12:30:25 | 0.0008975 | | | µg | | | 0.0008975 | | | | | |
| STD2=.04ug | 12/15/2010 | 12:31:40 | 0.0064427 | | | µg | | | 0.0064427 | | | | | |
| STD3=.08ug | 12/15/2010 | 12:32:56 | 0.01313 | | | µg | | | 0.01313 | | | | | |
| STD4=.16ug | 12/15/2010 | 12:34:12 | 0.0302799 | | | µg | | | 0.0302799 | | | | | |
| STD5=.2ug | 12/15/2010 | 12:35:30 | 0.030119 | | | µg | | | 0.030119 | | | | | |
| 0.004ug = DL | 12/15/2010 | 12:38:31 | 0.0007048 | 0.0038347 | 0.0038347 | µg | | | 0.0007048 | 0.0038347 | 0.0038347 | | | |
| 0.080ug = STD.2 | 12/15/2010 | 12:41:07 | 0.0159773 | 0.0869259 | 0.0869259 | µg | | | 0.0159773 | 0.0869259 | 0.0869259 | | | |
| 0.080ug = QC STD 3 | 12/15/2010 | 12:42:51 | 0.0160657 | 0.0874069 | 0.0874069 | µg | | | 0.0160657 | 0.0874069 | 0.0874069 | | | |
| 15849-1 C | 12/15/2010 | 12:45:50 | 0.0003047 | 0.0016576 | 0.1657626 | µg | 4 | 400 | 0.000342 | 0.0018606 | 0.1860557 | 0.0002674 | 0.0014547 | 0.1454695 |
| 15849-2 C | 12/15/2010 | 12:47:35 | 0.0005429 | 0.0029534 | 0.2953447 | µg | 4 | 400 | 0.0006373 | 0.0034673 | 0.34673 | 0.0004484 | 0.0024396 | 0.2439594 |
| 15849-2 C dup | 12/15/2010 | 12:49:21 | 0.0006247 | 0.0033985 | 0.3398479 | µg | 4 | 400 | 0.0006608 | 0.0035952 | 0.3595166 | 0.0005885 | 0.0032018 | 0.3201791 |
| 15849-3 C | 12/15/2010 | 12:51:06 | 0.000194 | 0.0010553 | 0.1055292 | µg | 4 | 400 | 0.0002321 | 0.0012628 | 0.1262813 | 0.0001558 | 0.0008478 | 0.0847772 |
| 15849-3 C spk | 12/15/2010 | 12:52:54 | 0.0146358 | 0.0796276 | 7.9627603 | µg | 4 | 400 | 0.0154149 | 0.0838665 | 8.386648 | 0.0138567 | 0.0753887 | 7.5388726 |
| 15849-5 C | 12/15/2010 | 12:56:31 | 0.0001916 | 0.0010424 | 0.1042371 | µg | 4 | 400 | 0.00021 | 0.0011424 | 0.1142388 | 0.0001732 | 0.0009424 | 0.0942355 |
| 0.004ug = DL | 12/15/2010 | 13:05:28 | 0.0007909 | 0.0043032 | 0.0043032 | µg | 4 | 400 | 0.0007909 | 0.0043032 | 0.0043032 | | | |
| 0.080ug = STD.2 | 12/15/2010 | 13:08:03 | 0.0153823 | 0.0836887 | 0.0836887 | µg | 4 | 400 | 0.0153823 | 0.0836887 | 0.0836887 | | | |
| REAGENT BLANK | 12/15/2010 | 13:09:19 | 0.0001592 | 0.0008659 | 0.0008659 | µg | 4 | 400 | 0.0001592 | 0.0008659 | 0.0008659 | | | |
| Calib Blank | 12/20/2010 | 13:03:20 | 0.0004034 | | | µg | | | 0.0004034 | | | | | |
| STD1=.004ug | 12/20/2010 | 13:04:35 | 0.0009064 | | | µg | | | 0.0009064 | | | | | |
| STD2=.04ug | 12/20/2010 | 13:05:52 | 0.0098448 | | | µg | | | 0.0098448 | | | | | |
| STD3=.08ug | 12/20/2010 | 13:07:09 | 0.0208179 | | | µg | | | 0.0208179 | | | | | |
| STD4=.16ug | 12/20/2010 | 13:08:27 | 0.0404666 | | | µg | | | 0.0404666 | | | | | |
| STD5=.2ug | 12/20/2010 | 13:09:47 | 0.0499321 | | | µg | | | 0.0499321 | | | | | |
| Reagent Blank | 12/20/2010 | 13:11:35 | -0.0000337 | -0.0001341 | -0.0001341 | µg | | | -0.0000091 | -0.0000362 | -0.0000362 | -0.0000584 | -0.000232 | -0.000232 |
| 0.004ug = DL | 12/20/2010 | 13:12:49 | 0.0009315 | 0.0037015 | 0.0037015 | µg | | | 0.0009315 | 0.0037015 | 0.0037015 | | | |
| 0.080ug = STD.2 | 12/20/2010 | 13:15:26 | 0.0210747 | 0.0837398 | 0.0837398 | µg | | | 0.0210747 | 0.0837398 | 0.0837398 | | | |
| 0.080ug = QC STD 3 | 12/20/2010 | 13:20:40 | 0.0211719 | 0.0841261 | 0.0841261 | µg | | | 0.0211719 | 0.0841261 | 0.0841261 | | | |
| REAGENT BLANK | 12/20/2010 | 13:21:57 | 0.0001216 | 0.0004831 | 0.0004831 | µg | | | 0.0001216 | 0.0004831 | 0.0004831 | | | |
| 15849-4 C | 12/20/2010 | 13:23:43 | 0.0001144 | 0.0004544 | 0.0454369 | µg | 4 | 400 | 8.326E-05 | 0.0003308 | 0.0330847 | 0.0001454 | 0.0005779 | 0.0577892 |
| 0.004ug = DL | 12/20/2010 | 13:43:36 | 0.0009652 | 0.0038351 | 0.0038351 | µg | 4 | 100 | 0.0009652 | 0.0038351 | 0.0038351 | | | |
| 0.080ug = STD.2 | 12/20/2010 | 13:44:53 | 0.0217067 | 0.0862512 | 0.0862512 | µg | 4 | 100 | 0.0217067 | 0.0862512 | 0.0862512 | | | |
| REAGENT BLANK | 12/20/2010 | 13:46:10 | 0.000152 | 0.0006038 | 0.0006038 | µg | 4 | 100 | 0.000152 | 0.0006038 | 0.0006038 | | | |

## PLANT DATA

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

**UNIT #3**

| Date | Test | Method # | Run # | Steam (klb/hr) | Run Length (hr) | Trash Processed (tons) |
|---|---|---|---|---|---|---|
| 12/8/2010 | Mercury | 29 | 1 | 179.6 | 2.25 | 65.6 |
| 12/8/2010 | Mercury | 29 | 2 | 179.9 | 2.13 | 62.2 |
| 12/8/2010 | Mercury | 29 | 3 | 180.0 | 2.08 | 60.8 |

***Wheelabrator***
***NORTH BROWARD***
***Emission Test Log***

Date: 12/08/10
Start Time: 8:04:00
End Time: 10:19:00

| | SDA INLET TEMP | SDA OUTLET TEMP | TOTAL SLURRY FL | DI WATER FLOW | TOTAL LIME | LIME CONC | FF OUT TEMP | FF DP | ID INLET PRESS | SPECIFIC GRAVITY |
|---|---|---|---|---|---|---|---|---|---|---|
| | DEG F | DEG F | GPM | GPM | GPM | % | DEG F | " H2O | " H2O | " H2O |
| Unit 1 | 510.10 | 319.64 | 37.68 | 27.04 | 10.64 | 15.85 | 304.10 | 7.18 | -10.64 | 1.101 |
| Unit 2 | 511.79 | 319.76 | 36.33 | 26.55 | 9.78 | 16.54 | 293.74 | 6.49 | -10.19 | 1.101 |
| Unit 3 | 506.53 | 320.05 | 37.76 | 27.52 | 10.24 | 16.43 | 306.35 | 6.50 | -8.03 | 1.101 |

| | 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 | AVAILABLE CaO |
|---|---|---|---|---|---|---|---|---|---|---|
| | KLBs/hr | DEG F | DEG F | KSCFM | " H2O | DEG F | DEG F | GPH | KLBs/hr | |
| Unit 1 | 188.23 | 895.89 | 825.59 | 68.97 | -0.10 | 260.67 | 1212.91 | 2.50 | 180.27 | 1.056 |
| Unit 2 | 186.93 | 898.09 | 827.02 | 80.19 | -0.10 | 271.96 | 1270.85 | 2.79 | 180.52 | 1.056 |
| Unit 3 | 189.39 | 900.07 | 833.23 | 76.59 | -0.09 | 280.93 | 1162.43 | 3.34 | 179.62 | 1.056 |

| | | |
|---|---|---|
| U1 lime (#/hr) | 673.89 | 8.09 |
| U2 lime (#/hr) | 619.48 | 7.43 |
| U3 lime (#/hr) | 648.70 | 7.78 |

***Wheelabrator***
***NORTH BROWARD***
***Emission Test Log***

Date: 12/08/10
Start Time: 10:45:00
End Time: 12:53:00

| | SDA INLET TEMP | SDA OUTLET TEMP | TOTAL SLURRY FL | DIL WATER FLOW | TOTAL LIME | LIME CONC | FF OUT TEMP | FF DP | ID INLET PRESS | SPECIFIC GRAVITY |
|---|---|---|---|---|---|---|---|---|---|---|
| | DEG F | DEG F | GPM | GPM | GPM | % | DEG F | " H2O | " H2O | " H2O |
| Unit 1 | 514.62 | 320.23 | 39.65 | 29.35 | 10.30 | 15.32 | 304.67 | 7.32 | -10.96 | 1.099 |
| Unit 2 | 511.69 | 319.84 | 35.94 | 29.61 | 6.33 | 16.97 | 292.87 | 6.29 | -9.84 | 1.099 |
| Unit 3 | 509.19 | 319.85 | 38.14 | 30.36 | 7.78 | 17.03 | 306.82 | 6.44 | -7.77 | 1.099 |

| | 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 | AVAILABLE CaO |
|---|---|---|---|---|---|---|---|---|---|---|
| | KLBs/hr | DEG F | DEG F | KSCFM | " H2O | DEG F | DEG F | GPH | KLBs/hr | |
| Unit 1 | 187.22 | 895.58 | 824.02 | 70.29 | -0.10 | 260.94 | 1236.56 | 2.51 | 179.91 | 1.039 |
| Unit 2 | 186.86 | 897.89 | 830.97 | 80.68 | -0.10 | 271.90 | 1270.43 | 2.49 | 179.73 | 1.039 |
| Unit 3 | 189.04 | 899.62 | 826.82 | 77.60 | -0.09 | 280.84 | 1157.99 | 3.00 | 179.93 | 1.039 |

| | | |
|---|---|---|
| U1 lime (#/hr) | 642.26 | 7.71 |
| U2 lime (#/hr) | 394.51 | 4.73 |
| U3 lime (#/hr) | 484.88 | 5.82 |

***Wheelabrator***
***NORTH BROWARD***
***Emission Test Log***

Date: 12/08/10
Start Time: 13:10:00
End Time: 15:15:00

| | SDA INLET TEMP | SDA OUTLET TEMP | TOTAL SLURRY FLO | DIL WATER FLOW | TOTAL LIME | LIME CONC | FF OUT TEMP | FF DP | ID INLET PRESS | SPECIFIC GRAVITY |
|---|---|---|---|---|---|---|---|---|---|---|
| | DEG F | DEG F | GPM | GPM | GPM | % | DEG F | " H2O | " H2O | " H2O |
| Unit 1 | 520.38 | 319.73 | 42.45 | 34.12 | 8.33 | 14.72 | 304.03 | 7.36 | -11.22 | 1.098 |
| Unit 2 | 520.97 | 320.25 | 39.63 | 33.18 | 6.45 | 15.78 | 294.06 | 6.46 | -10.17 | 1.098 |
| Unit 3 | 511.37 | 320.22 | 39.12 | 29.23 | 9.89 | 17.04 | 307.83 | 6.50 | -7.70 | 1.098 |

| | 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 | AVAILABLE CaO |
|---|---|---|---|---|---|---|---|---|---|---|
| | KLBs/hr | DEG F | DEG F | KSCFM | " H2O | DEG F | DEG F | GPH | KLBs/hr | |
| Unit 1 | 187.88 | 895.51 | 824.35 | 70.39 | -0.10 | 261.42 | 1238.55 | 2.50 | 180.21 | 1.024 |
| Unit 2 | 186.19 | 897.62 | 828.30 | 80.81 | -0.10 | 272.04 | 1266.14 | 2.54 | 179.97 | 1.024 |
| Unit 3 | 188.83 | 899.48 | 826.08 | 77.37 | -0.09 | 280.98 | 1162.28 | 3.47 | 180.02 | 1.024 |

| | | |
|---|---|---|
| U1 lime (#/hr) | 511.76 | 6.14 |
| U2 lime (#/hr) | 396.05 | 4.75 |
| U3 lime (#/hr) | 607.70 | 7.29 |