January 25, 2008

Charlie Cary
Biomass Combustion Systems
67 Millbrook Street, #505
Worcester, MA 01606

**RE: Wood Furnace Emissions Testing Results**
**CK Project 3225**

Dear Mr. Cary:

CK Environmental, Inc. (CK) performed particulate matter (PM), condensable particulate matter (CPM), nitrogen oxides (NOx), and carbon monoxide (CO) emissions testing of a 36" Shop Heater with a heat input rating of 999,000 BTU/hr using EPA Reference Methods 1-5/202, 7E and 10. Furnace emissions exhausted to the atmosphere through a 12 inch (nominal) diameter stack. This report presents the results of testing performed December 5, 2007.

The subject unit burns milled wood scraps from a sash and window manufacturing process. A representative sample of wood was submitted to Desert Analytics for analysis. A copy of the analytical report is located in Appendix B. The heating value of the sample "as received" by the laboratory was 8,474 BTU/lb. This value was used to calculate pollutant emission rates (lbs/MMBtu).

Three 1-hour test runs were performed. PM and CPM samples were submitted to Maxxam Analytical, Inc. for analyses. Table 1 presents a summary of results. The heat input during testing averaged 0.94 MMBtu/hr which resulted in an average total particulate (PM & CPM) emission rate was 0.086 lbs/MMBtu. NOx emissions averaged 0.050 lbs/MMBtu.

Sampling was conducted by trained personnel with extensive experience in Reference Method sampling. All sampling and analyses were conducted in strict accordance with the following EPA test procedures, including quality control procedures found in the EPA Quality Assurance Handbook for Air Pollution Measurement Systems.

| | |
|---|---|
| EPA Methods 1-5 | - Determination of Particulate Matter (PM) Emissions from Stationary Sources |
| EPA Method 3A | - Determination of Oxygen (O2) and Carbon Dioxide (CO2) Concentration Emissions from Stationary Sources |
| EPA Method 7E | - Determination of Nitrogen Oxide (NOx) Emissions from Stationary Sources |
| EPA Method 10 | - Determination of Carbon Monoxide (CO) Emissions from Stationary Sources |
| EPA Method 202 | - Determination of Condensable Particulate Matter (CPM) from Stationary Sources |

CK's entire equipment inventory is on a schedule of routine maintenance and calibration. All calculations were conducted in accordance with the equations found in the individual Methods. Emission rate calculations were checked by a second individual to ensure that they are correct. These specific procedures validate the results obtained during the test program. The majority of CK's emissions testing work is performed for compliance purposes, which require strict

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QC procedures. This testing program was performed using those same procedures.

Supporting documentation is enclosed with this report. Field data sheets together with reduced data worksheets are located in Appendix A. Appendix B contains laboratory reports.

Please contact me (toll free 888-CKE-0303 or kkelley@ckenvironmental.com) should you have any questions regarding the performance, or finding, of this testing program.

Sincerely,

Kevin J. Kelley
Program Manager

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www.**ck**environmental.com

Table 1 – Summary of Results

| TEST NUMBER: | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| DATE: | | 12/6/2007 | 12/6/2007 | 12/6/2007 | |
| START TIME : | | 0951 | 1133 | 1420 | |
| | UNITS | | | | AVERAGE |
| **PROCESS CONDITIONS** | | | | | |
| Wood Feed Rate | lb/hr | 120 | 107 | 107 | 111 |
| **SAMPLE CONDITIONS** | | | | | |
| Meter Volume | dscf | 45.50 | 46.31 | 44.93 | 45.58 |
| Isokinesis | % | 99.7 | 99.6 | 98.2 | - |
| Total Particulate Catch | mg | 52.1 | 52.5 | 41.2 | - |
| **STACK CONDITIONS** | | | | | |
| Stack Gas Flowrate | dscf/min | 580 | 590 | 580 | 580 |
| Average Stack Temperature | °F | 198 | 201 | 175 | 191 |
| Water Vapor in Stack Gas | % | 2.5 | 3.2 | 3.1 | 3.0 |
| CO2 in Stack Gas | % | 3.9 | 2.4 | 2.6 | 3.0 |
| O2 in Stack Gas | % | 16.6 | 18.3 | 17.9 | 17.6 |
| CO in Stack Gas | ppm | 315 | 485 | 205 | 335 |
| **MEASURED EMISSIONS** | | | | | |
| NOx in Stack Gas | ppm | 14.1 | 9.1 | 11.0 | 11.4 |
| NOx Emission Rate | lbs/hr | 0.059 | 0.038 | 0.046 | 0.048 |
| **NOx Emission Rate** | **lb/MMBtu** | **0.058** | **0.042** | **0.050** | **0.050** |
| Particulate Emission Concentration | gr/dscf | 0.0177 | 0.0175 | 0.0142 | 0.0164 |
| Mass Emission Rate | lbs/hr | 0.087 | 0.088 | 0.070 | 0.08 |
| Fuel Heating Value | BTU/lb | 8474 | 8474 | 8474 | 8474 |
| Heat Input | MMBTU/hr | 1.017 | 0.907 | 0.907 | 0.943 |
| **Particulate Emissions** | **lb/MMBtu** | **0.086** | **0.097** | **0.077** | **0.086** |

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# APPENDIX A

# FIELD DATA SHEETS

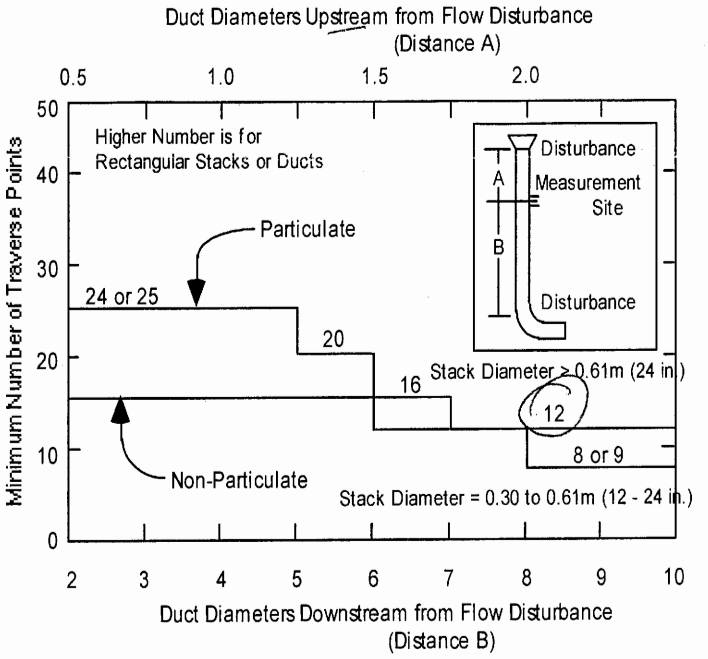
# EPA Method 1

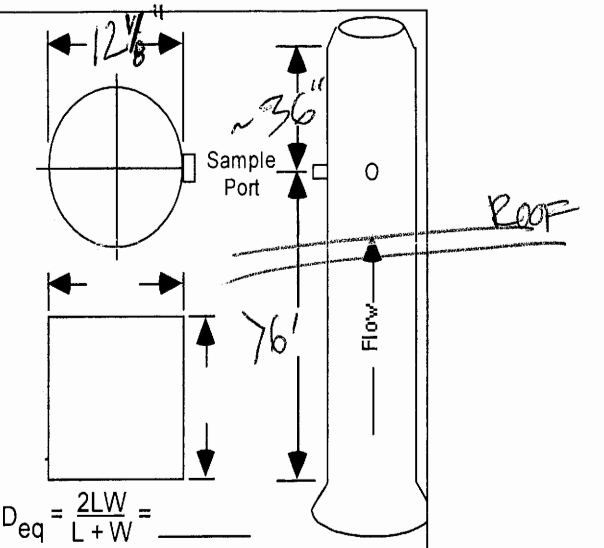
Sample and Velocity Traverse for Stationary Sources

Firm BIOMASS COMBUSTION @ BOSTON SCH
Date 12/5/07 Project No.
Location WOOD-FIRED FURNACE STACK
Diameters Upstream 3
Diameters Downstream >6

Total Traverse Points Required 12
Number of Ports 2
Points Per Port 6
Probe Traverses: Horizontal
Vertical

MINIMUM NUMBER OF TRAVERSE POINTS FOR PARTICULATE AND NON-PARTICULATE TRAVERSES




$D_{eq} = \frac{2LW}{L+W} =$ _____

| Cross-Sectional Layout For Rectangular Stack | |
|---|---|
| Traverses | Matrix |
| 9 | 3x3 |
| 12 | 4x3 |
| 16 | 4x4 |
| 20 | 5x4 |
| 25 | 5x5 |

| Point On A Diameter | Location of Traverse Points in Circular Stacks* Number of Traverse Points on a Diameter | | | | | Traverse Point Location | | |
|---|---|---|---|---|---|---|---|---|
| | 4 | 6 | 8 | 10 | 12 | Distance From Wall | Nipple Size | Total Distance |
| 1 | 6.7 | 4.4 | 3.2 | 2.6 | 2.1 | 0.5 | 2" | 2.5 |
| 2 | 25.0 | 14.6 | 10.5 | 8.2 | 6.7 | 1.8 | | 3.8 |
| 3 | 75.0 | 29.6 | 19.4 | 14.6 | 11.8 | 3.6 | | 5.6 |
| 4 | 93.3 | 70.4 | 32.3 | 22.6 | 17.7 | 8.5 | | 10.5 |
| 5 | | 85.4 | 67.7 | 34.2 | 25.0 | 10.4 | | 12.4 |
| 6 | | 95.6 | 80.6 | 65.8 | 35.6 | 11.6 | | 13.6 |
| 7 | | | 89.5 | 77.4 | 64.4 | | | |
| 8 | | | 96.8 | 85.4 | 75.0 | | | |
| 9 | | | | 91.8 | 82.3 | | | |
| 10 | | | | 97.4 | 88.2 | | | |
| 11 | | | | | 93.3 | | | |
| 12 | | | | | 97.9 | | | |

*Percent of Stack Diameter from Inside Wall to Traverse Point

0

ESZ 1.6676
AHe 1.6898
Y = 0.9942
1.0083

# EPA Method 2

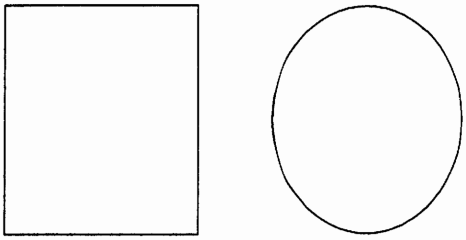
Velocity Traverse and
Flow Rate Determination

Pre-test flow

Firm: Biomass Combustion @ Boston Sash
Date: 12/6/07 Project No. ______
Location: Woodfired furnace stack

**Round Stack or Duct:**
Diameter (in): 12 1/8" (12.125") Area ______ ft^2

**Rectangular Stack or Duct:**
Stack Length (in): ______ Area ______ ft^2
Stack Width (in): ______
Barometric Pressure; Pb = ______ in. Hg
Stack Static Pressure; Pg = 0.04 in. H2O
Stack Gas Moisture Content; % H2O = ______
Stack Gas Molecular Weight; (wet) Mw = ______
Pitot Tube No. ______ Cp = 0.84
Field Tester(s) ______
Test Start Time: ______ Finish: ______



Schematic of Traverse Point Locations

Cyclonic Flow Angle: + Ø Clockwise
- Ø Counterwise

| PORT | POINT | dP (Inch H2O) | SqRoot dP | Ts (°F) | ± Ø | Pitots Reversed for Negative Flow? | RADIANS | SqR dP*cosØ |
|---|---|---|---|---|---|---|---|---|
| A | 1 | 0.06 | | 108 | | | | |
| | 2 | 0.065 | | 125 | | | | |
| | 3 | 0.07 | | 136 | | | | |
| | 4 | 0.065 | | 141 | | | | |
| | 5 | 0.065 | | 144 | | | | |
| | 6 | 0.055 | | 136 | | | | |
| | | | | | | | | |
| B | 1 | 0.05 | | 94 | | | | |
| | 2 | 0.06 | | 104 | | | | |
| | 3 | 0.065 | | 116 | | | | |
| | 4 | 0.07 | | 121 | | | | |
| | 5 | 0.06 | | 126 | | | | |
| | 6 | 0.05 | | 124 | | | | |
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| | | | | | | | | |
| | | AVERAGE | | | | | AVERAGE | |

Absolute Gas Temperature; Tst = Ts + 460° ______ ° R
Absolute Gas Pressure; Ps = Pb + Pg/13.6 ______ in. Hg
Gas Velocity; Vs = (85.49)Cp(??P*cosØ)avg?(Tst avg/(Ps*Mw)) ______ ft/sec
Actual Gas Flow Rate; Qa = (Vs)(60)(A) #VALUE! acfm
Standard Gas Flow Rate; Qs = Qa(528°R/Tst)(Ps/29.92) ______ scfm
Dry Standard Gas Flow Rate; Qsd = Qa(528°R/Tst)(Ps/29.92)((100-%H2O)/100) ______ dscfm

Rev 7/95 TMC

Page ____ of ____

# EPA Method 5

Particulate Test Data Sheet

Client/Firm: BIOMASS COMBUSTION @ BOSTON SASH
Location: WOODFIREDFURNACE STACK
Project No.: ____ Test Number: 1
Testers Initials: KSF Test Date: 12/6/07
Test Time(min): 60 Start Time: 0951
Min Per Point: 5 End Time: ____

Assumed Moisture: 5 (%)
Pb = ____ (in Hg)
Nozzle Size: 0.441
Nozzle No.: 155006
C/K Factor: 29.14

Module No.: ES2
dH@ = 1.6676
Cp = 0.84
Y = 1.0080
Probe No.: ____
Pitot No.: ____
Filter No.: 2006090606

**Signature of Train Operator:** ____

Rectangular Stack: Length (in) ____ Width (in) ____
Circular Stack: Diameter (in) 12.125 Area (ft^2) ~~0.00~~
Train Leak Checks: Pre-Test 0.01 cfm 3 in Hg
Post-Test 0.01 cfm 10 in Hg
Orsat Leak Check: Pre-Test ____ Post-Test ____
Pitot Leak Check: Pre-Test ____ Post-Test ____
Final Orsat Analysis ____ O2% ____ CO2%

| Port | Point | Time (min) | Meter Volume (ft^3) | dP (in H2O) | dH (in H2O) | Temperatures: Stack (°F) | Probe (°F) | Htr Box (°F) | Filter (°F) | Cond Out (°F) | Module Meter In (°F) | Module Meter Out (°F) | Vacuum (in Hg) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | 0 | 271.290 | 0.07 | 2.04 | 242 | 237 | | 212 | 29 | 40 | 34 | 2 | Static Pressure: in H2O |
| | 2 | 5 | 275.4 | 0.07 | 2.04 | 235 | 239 | | 232 | 34 | 43 | 35 | 3 | dP 0.045, dH 1.31 |
| | 3 | 10 | 279.0 | 0.65 | 1.89 | 236 | 239 | | 234 | 36 | 44 | 36 | 3 | 0.05, 1.46 |
| | 4 | 15 | 283. | 0.060 | 1.75 | 204 | 237 | | 230 | 39 | 46 | 37 | 3 | 0.055, 1.60 |
| | 5 | 20 | 286.4 | 0.055 | 1.6 | 184 | 236 | | 236 | 41 | 46 | 38 | 3 | 0.06, 1.75 |
| | 6 | 25 | 289.4 | 0.05 | 1.46 | 93 | 239 | | 237 | 42 | 47 | 39 | 3 | 0.065, 1.89 |
| | | 30 | 293 | | | | | | | | | | | 0.07, 2.04 |
| B | 1 | | | 0.05 | 1.46 | 93 | 237 | | 236 | 44 | 47 | 39 | 3 | 0.075, 2.19 |
| | 2 | | 296.2 | 0.05 | 1.46 | 162 | 239 | | 237 | 44 | 47 | 39 | 3 | |
| | 3 | | 299.5 | 0.055 | 1.6 | 184 | 239 | | 236 | 46 | 47 | 39 | 3 | |
| | 4 | | 302.6 | 0.06 | 1.75 | 224 | 239 | | 237 | 48 | 49 | 40 | 3 | |
| | 5 | | 306. | 0.07 | 2.04 | 270 | 239 | | 237 | 48 | 49 | 41 | 6 | |
| | 6 | | 310.0 | 0.075 | 2.04 | 270 | 240 | | 236 | 52 | 51 | 43 | 6 | |
| | END | | 313.911 | | | | | | | | | | | |

| Impinger Recovery | | | |
|---|---|---|---|
| Impinger Number | Vol or Wt Initial | Vol or Wt Final | Total Catch |
| 1 | 100 | 103 | 3 |
| 2 | 100 | 109 | 9 |
| 3 | 0 | 2 | 2 |
| 4 | | | |
| Other(s) | | | |
| Silica Gel | 702.8 | 713.5 | 10.7 |

Final Reading: ____ Average ____ Average of In & Out Meter Temperatures
Total Volume: ____ Avg Square Root dP ____

Rev 9/95 TMC

Total Moisture Catch: ____ Calculated Moisture Content: 24.7

# EPA Method 5

Particulate Test Data Sheet

Client/Firm: Biomass Combustion @ Boston Sash
Location: Wood fired furnace STACK
Project No.: ____ Test Number: 2
Testers Initials: KMC Test Date: 12/6/07
Test Time(min): 60 Start Time: 1133
Min Per Point: 5 End Time: ____

Assumed Moisture: ____ (%)
Pb = ____ (in Hg)
Nozzle Size: 0.441
Nozzle No.: 155006
C/K Factor: 29.14

Module No.: ES2
dH@ = 1.6676
Cp= 0.84
Y = 1.0080
Probe No.: M5-16
Pitot No.: ____
Filter No.: 2006090604

**Signature of Train Operator:** ____

Rectangular Stack: Length (in) ____ Width (in) ____
Circular Stack: Diameter (in) 12.125 Area (ft^2) 0.00
Train Leak Checks: Pre-Test <0.01 cfm 10 in Hg
Post-Test <0.01 cfm 17 in Hg
Orsat Leak Check: Pre-Test ____ Post-Test ____
Pitot Leak Check: Pre-Test ____ Post-Test ____
Final Orsat Analysis ____ O2% ____ CO2%

| Port | Point | Time (min) | Meter Volume (ft^3) | dP (in H2O) | dH (in H2O) | Temperatures: Stack (°F) | Probe (°F) | Htr Box (°F) | Filter (°F) | Cond Out (°F) | Module Meter: In (°F) | Module Meter: Out (°F) | Vacuum (in Hg) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1133 A | 1 | 0 | 314.257 | 0.07 | 2.04 | 209 | 255 | | 210 | 37 | 47 | 44 | 5 | Static Pressure: in H2O |
| 1138 | 2 | 5 | 318.1 | 0.07 | 2.04 | 213 | 254 | | 232 | 41 | 49 | 44 | 6 | |
| 1143 | 3 | 10 | 321.9 | 0.07 | 2.04 | 219 | 255 | | 236 | 43 | 51 | 44 | 7 | dP dH |
| 1148 | 4 | 1145 15 | 325.8 | 0.06 | 1.75 | 241 | 253 | | 236 | 44 | 51 | 45 | 6 | 0.045 1.31 |
| | 5 | 1153 20 | 329.4 | 0.06 | 1.75 | 232 | 254 | | 239 | 46 | 52 | 46 | 6 | 0.05 1.46 |
| | 6 | 1158 25 | 332.9 | 0.05 | 1.46 | 151 | 255 | | 236 | 49 | 52 | 46 | 5 | 0.55 1.60 |
| | B | 1203 30 | 336.3 | 0.05 | 1.46 | 90 | 253 | | 237 | 51 | 52 | 46 | 5 | 0.6 1.75 |
| | 5 | 1208 35 | 339.4 | 0.05 | 1.46 | 142 | 255 | | 240 | 52 | 52 | 47 | 6 | 0.65 1.89 |
| | 4 | 1213 40 | 342.6 | 0.06 | 1.75 | 194 | 257 | | 239 | 54 | 53 | 47 | 8 | 0.7 2.04 |
| | 3 | 1218 45 | 346.2 | 0.07 | 2.04 | 245 | 257 | | 234 | 55 | 53 | 47 | 9 | 0.75 2.19 |
| | 2 | 1223 50 | 350.1 | 0.07 | 2.04 | 239 | 257 | | 240 | 55 | 53 | 47 | 10 | |
| | 1 | 1228 55 | 354.0 | 0.07 | 2.04 | 246 | 257 | | 240 | 58 | 54 | 48 | 10 | |
| | END | 1233 60 | 357.859 | | | | | | | | | | | |

**Impinger Recovery**

| Impinger Number | Vol or Wt Initial | Vol or Wt Final | Total Catch |
|---|---|---|---|
| 1 | 679.6 | 682.1 | 2.5 |
| 2 | 689.8 | 704.1 | 14.3 |
| 3 | 526.6 | 530.7 | 4.1 |
| 4 | | | |
| Other(s) | | | |
| Silica Gel | 806.3 | 818.3 | 12 |

Final Reading: ____ Average ____ Average of In & Out Meter Temperatures
Total Volume: ____ Avg Square Root dP ____

Total Moisture Catch: ____ Calculated Moisture Content: 32.7

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# EPA Method 5

Particulate Test Data Sheet

Client/Firm: Biomass Combustion @ Boston Sash
Location: Wood Fired Furnace Stack
Project No.:
Testers Initials: KTC
Test Time(min): 60
Min Per Point: 5

Test Number: 3
Test Date: 12/6/07
Start Time: 1420
End Time:

Assumed Moisture: ____ (%)
Pb = ____ (in Hg)
Nozzle Size: 0.441
Nozzle No.: 155006
C/K Factor: 29.14

Module No.: ES2
dH@ = 1.6676
Cp= 0.84
Y = 1.0080
Probe No.: MS-16
Pitot No.:
Filter No.: 20060906005

**Signature of Train Operator:**

Rectangular Stack: Length (in) ____ Width (in) ____
Circular Stack: Diameter (in) 12.125 Area (ft^2) 0.00
Train Leak Checks: Pre-Test 0 cfm 10 in Hg
Post-Test 0 cfm 12 in Hg
Orsat Leak Check: Pre-Test ____ Post-Test ____
Pitot Leak Check: Pre-Test ____ Post-Test ____
Final Orsat Analysis ____ O2% ____ CO2%

| Port | Point | Time (min) | Meter Volume (ft^3) | dP (in H2O) | dH (in H2O) | Temperatures: Stack (°F) | Probe (°F) | Htr Box (°F) | Filter (°F) | Cond Out (°F) | Module Meter In (°F) | Module Meter Out (°F) | Vacuum (in Hg) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | 1420 0 | 358.052 | 0.65 | 1.89 | 194 | 255 | | 248 | 36 | 42 | 42 | 4 | Static Pressure: in H2O |
| | 2 | 1425 5 | 361.8 | 0.60 | 1.75 | 197 | 254 | | 237 | 39 | 44 | 42 | 4 | |
| | 3 | 1430 10 | 365.3 | 0.60 | 1.75 | 219 | 253 | | 234 | 42 | 46 | 41 | 4 | dP dH |
| | 4 | 1435 15 | 368.9 | 0.60 | 1.75 | 202 | 253 | | 239 | 42 | 47 | 41 | 5 | 0.45 1.31 |
| | 5 | 1440 20 | 372.4 | 0.50 | 1.46 | 158 | 255 | | 236 | 46 | 49 | 42 | 4 | 0.50 1.46 |
| | 6 | 1445 25 | 375.7 | 0.45 | 1.31 | 74 | 255 | | 236 | 47 | 49 | 42 | 4 | 0.55 1.60 |
| | 6 | 1450 30 | 378.9 | 0.45 | 1.31 | 65 | 254 | | 240 | 48 | 49 | 43 | 4 | 0.60 1.75 |
| | 5 | 1455 35 | 382.0 | 0.5 | 1.46 | 93 | 253 | | 237 | 50 | 49 | 43 | 5 | 0.65 1.89 |
| | 4 | 1500 40 | 385.7 | 0.55 | 1.6 | 172 | 256 | | 237 | 53 | 49 | 43 | 5 | 0.70 2.04 |
| | 3 | 1505 45 | 388.6 | 0.65 | 1.89 | 233 | 255 | | 234 | 57 | 50 | 43 | 7 | 0.75 2.19 |
| | 2 | 1510 50 | 392.3 | 0.70 | 2.04 | 249 | 256 | | 233 | 59 | 51 | 44 | 8 | |
| | 1 | 1515 55 | 396.1 | 0.70 | 2.04 | 235 | 254 | | 232 | 59 | 51 | 44 | 8 | |
| | END | 1520 60 | 400.044 | | | | | | | | | | | |

**Impinger Recovery**

| Impinger Number | Vol or Wt Initial | Vol or Wt Final | Total Catch |
|---|---|---|---|
| 1 | 713.6 | 715.7 | 2.1 |
| 2 | 724.3 | 737.6 | 13.3 |
| 3 | 523.2 | 527.8 | 4.6 |
| 4 | | | |
| Other(s) | | | |
| Silica Gel | 785.3 | 796.8 | 11.5 |

**Final Reading:** ____ **Average** ____ **Average of In & Out Meter Temperatures**
**Total Volume:** ____ **Avg Square Root dP** ____

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**Total Moisture Catch:** ____ **Calculated Moisture Content:** 31.5

WOOD LOAD  RUN 1 = 20 lbs/10 min

RUN 2+3: 17 lbs/10 min

# SYSTEM CALIBRATION SHEET

PLANT: BOSTON SASH/BIOMASS COMB  DATE: 12/6/07

TEST LOCATION: BIOMASS BLR  OPERATOR: MK

FUEL: WOOD  SYSTEM RESPONSE TIME:

| | | $O_2$ RANGE: 25 | | $CO_2$ RANGE: 20 | | CO RANGE: | | $SO_2$ RANGE: | | NOx RANGE: | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ZERO | SPAN | ZERO | SPAN | ZERO | SPAN | ZERO | SPAN | ZERO | SPAN |
| RUN: 1 START TIME: 09:50 END TIME: 10:50 | ANALYZER CAL RESPONSE | 0.1 | 11.1 | 0.0 | 11.2 | 0.1 | 292 | | | 0.2 | 251.0 |
| | INITIAL SYSTEM CAL RESPONSE | 0.7 | 10.7 | 0.0 | 11.0 | 2.6 | 282 | | | 0.7 | 246 |
| | SYSTEM BIAS | 0.0 | 1.6 | 0.0 | 0.0 | 0.5 | 2.0 | | | 0.10 | 1.0 |
| | FINAL SYSTEM CAL RESPONSE | 0.0 | 10.5 | 0.4 | 11.1 | 3.2 | 279.5 | | | 0.7 | 250.6 |
| | SYSTEM BIAS | 0.4 | 2.4 | 2.0 | 0.5 | 0.6 | 2.7 | | | 0.1 | 0.1 |
| | SYSTEM DRIFT | 0.4 | 0.8 | 2.0 | 0.5 | 0.1 | 0.5 | | | 0.0 | 0.9 |
| | NON CAL. CORR. AVERAGE | 16.6 | | 3.9 | | 315.3 | | | | 14.1 | |
| RUN: 2 START TIME: 11:33 END TIME: 12:33 | INITIAL SYSTEM CAL RESPONSE | 0.0 | 10.5 | 0.4 | 11.1 | 3.2 | 279.5 | | | 0.7 | 250.6 |
| | SYSTEM BIAS | 0.4 | 2.4 | 2.0 | 0.5 | 0.6 | 2.7 | | | 0.1 | 0.1 |
| | FINAL SYSTEM CAL RESPONSE | 0.2 | 10.8 | 0.0 | 10.7 | 4.0 | 278.5 | | | 0.2 | 238.5 |
| | SYSTEM BIAS | 0.4 | 1.2 | 0.0 | 2.5 | 0.8 | 2.8 | | | 0.0 | 2.7 |
| | SYSTEM DRIFT | 0.8 | 1.2 | 2.0 | 2.0 | 0.2 | 0.2 | | | 0.1 | 2.6 |
| | NON CAL. CORR. AVERAGE | 18.3 | | 2.4 | | 485. | | | | 9.1 | |
| RUN: 3 START TIME: 14:20 END TIME: | INITIAL SYSTEM CAL RESPONSE | 0.2 | 10.8 | 0.0 | 10.7 | 4.0 | 278.5 | | | 0.2 | 238.5 |
| | SYSTEM BIAS | 0.4 | 1.2 | 0.0 | 2.5 | 0.8 | 2.8 | | | 0.0 | 2.7 |
| | FINAL SYSTEM CAL RESPONSE | 0.3 | 10.6 | 0.2 | 10.5 | 3.6 | 282.1 | | | 0.6 | 241.5 |
| | SYSTEM BIAS | | | | | | | | | | |
| | SYSTEM DRIFT | | | | | | | | | | |
| | NON CAL. CORR. AVERAGE | 17.9 | | 2.6 | | 204.5 | | | | 11.0 | |

SYSTEM BIAS = [(SYSTEM RESPONSE - ANALYZER RESPONSE) / HIGH CYLINDER VALUE] * 100

ERROR MUST NOT EXCEED 5% OF HIGH CYLINDER VALUE

SYSTEM DRIFT = [(INITIAL SYSTEM RESPONSE - FINAL SYSTEM RESPONSE) / HIGH CYLINDER VALUE] * 100

ERROR MUST NOT EXCEED 3% OF HIGH CYLINDER VALUE

- MONARCH TIME = 1 HR AHEAD OF ACTUAL
- RUN 2 @ REDUCED FEED RATE

CK Environmental, Inc.
1020 Turnpike St., Suite 8
Canton, MA 02021 USA
*Toll-free:* 888-CKE-0303
*International:* 781-828-5200
*Fax:* 781-828-5380
www.ckenvironmental.com

Environmental

# ANALYZER CALIBRATION SHEET

PLANT: Biomass Comb & Boston Wash DATE: 12/6/07

TEST LOCATION: Biomass BLR OPERATOR: MK

FUEL: Wood

| GAS | RANGE | CYLINDER VALUE | ANALYZER RESPONSE | ABSOLUTE DIFFERENCE | ANALYZER CAL. ERROR |
|---|---|---|---|---|---|
| $O_2$ | ZERO | 0.0 | 0.1 | 0.1 | 0.4 |
| | MID | 10.96 | 11.1 | 0.1 | 0.4 |
| | HIGH | 21.1 | 21.0 | 0.1 | 0.4 |
| $CO_2$ | ZERO | 0.0 | 0.0 | 0.0 | 0.0 |
| | MID | 11.12 | ~~17.6~~ 11.2 | 0.1 | 0.5 |
| | HIGH | 17.6 | 17.6 | 0.0 | 0.0 |
| CO | ZERO | 0.0 | 0.1 | 0.1 | 0.0 |
| | MID | 292 | 292 | 0.0 | 0.0 |
| | HIGH | 496 | 492.0 | 4.0 | 0.8 |
| $SO_2$ | ZERO | 0.0 | | | |
| | MID | | | | |
| | HIGH | | | | |
| NOx | ZERO | 0.0 | 0.2 | 0.2 | 0.1 |
| | MID | 245 | 251.0 | 6.0 | 1.2 |
| | HIGH | 503 | 499.9 | 3.1 | 0.6 |

ANALYZER CAIBRATION ERROR = [(ANALYZER RESPONSE - CYLINDER VALUE) / HIGH CYLINDER VALUE] * 100

ERROR MUST NOT EXCEED 2% OF HIGH CYLINDER VALUE

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Canton, MA 02021 USA
Toll-free: 888-CKE-0303
International: 781-828-5200
Fax: 781-828-5380

# APPENDIX B

# LABORATORY REPORT

DESERT ANALYTICS
A Columbia Analytical Services, Inc. Company

*November 29, 2007*

**Client:** **CK Environmental, Inc.**
**1020 Turnpike St.**
**Suite 8**
**Canton, MA 02021**

**Attn:** **Becky Travis**

**Project:** **PO 3670RGT** ***Date Received:*** **November 12, 2007**

## *Certificate of Analysis*

| *Analyses* | *Method* | *Sample ID* | Wood Fuels 12 blocks | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | *Date/Time* | | | | | | |
| | | *Lab #* | DA07-8874 | | | | | |
| | | *units* | *As Received* | *Moisture Free* | *As Received* | *Moisture Free* | *As Received* | *Moisture Free* |
| ***Proximate Analysis*** | | | | | | | | |
| ***Moisture*** | ***E871*** | % | 5.42 | | | | | |
| ***Ash*** | ***D1102*** | % | 0.49 | 0.51 | | | | |
| ***Ultimate*** | ***D3176*** | | | | | | | |
| ***Carbon*** | | % | 47.96 | 50.71 | | | | |
| ***Hydrogen*** | | % | 6.21 | 5.92 | | | | |
| ***Nitrogen*** | | % | 0.06 | 0.06 | | | | |
| ***Oxygen*** | | | 45.27 | 42.77 | | | | |
| ***Sulfur*** | | % | 0.012 | 0.012 | | | | |
| ***Heating Value*** | ***D5865*** | *BTU/lb* | 8,474 | 8,960 | | | | |

***Notes:***

RV Poulsen RVP

Ralph V. Poulsen, Lab Director

*3860 S. Palo Verde Rd.*
*Suite 303*
*Tucson, AZ 85714*
*520.623.3381*

Your Project #: 3225
Site: BOIMASS COMBUSTION

**Attention: Kevin Kelley**
CK ENVIRONMENTAL
1020 Turnpike St
Unit 8
Canton, MA
USAE 2021

**Report Date: 2008/01/03**

## CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: A7D8796**
**Received: 2007/12/13, 12:00**

Sample Matrix: Filter
# Samples Received: 3

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Method Reference |
|---|---|---|---|---|---|
| Particulates in Acetone Rinse (M5/315) | 3 | 2007/12/27 | 2008/01/02 | BRL SOP-00109 | EPA 5/315 |
| Particulates on Filter (M5/315/NJATM1) | 3 | 2007/12/19 | 2007/12/22 | BRL SOP-00109 | EPA 5/315/NJATM1 |
| Final Volume of Acetone Probe Rinse | 3 | 2007/12/21 | 2007/12/27 | | |

Sample Matrix: Impinger Solution
# Samples Received: 6

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Method Reference |
|---|---|---|---|---|---|
| Extractable Condensables (M202) | 3 | 2007/12/22 | 2007/12/30 | BRL SOP-00118 | EPA 202 |
| Non Extractable Condensibles (M202) | 6 | 2007/12/27 | 2008/01/02 | BRL SOP-00118 / BRL SOP-00109 | EPA 202 |
| Volume of DCM Received | 3 | 2007/12/22 | 2007/12/22 | | |
| Final Volume of Impinger | 6 | 2007/12/22 | 2007/12/22 | | |

**MAXXAM ANALYTICS INC.**

ANCY SEBASTIAN, C.Tech.
Senior Project Manager, Air Toxics

AMS/ams
encl.

../2



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Your Project #: 3225
Site: BOIMASS COMBUSTION

**Attention: Kevin Kelley**
CK ENVIRONMENTAL
1020 Turnpike St
Unit 8
Canton, MA
USAE 2021

**Report Date: 2008/01/03**

## CERTIFICATE OF ANALYSIS

-2-

**PM Released by :**
ANCY SEBASTIAN, C.Tech.
Senior Project Manager, Air Toxics

Total cover pages: 2



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Maxxam Job #: A7D8796
Report Date: 2008/01/03

CK ENVIRONMENTAL
Client Project #: 3225
Project name: BOIMASS COMBUSTION
Sampler Initials:

## RESULTS OF ANALYSES OF FILTER

| Maxxam ID | | W41526 | W41527 | W41528 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2007/12/06 | 2007/12/06 | 2007/12/06 | | |
| | **Units** | **RUN 1** | **RUN 2** | **RUN 3** | **RDL** | **QC Batch** |
| Particulate Weight in Acetone Rinse | mg | 8.7 | 4.0 | 3.9 | 0.5 | 1434814 |
| Volume | ml | 69 | 63 | 80 | 1 | 1433658 |
| Particulate Weight on Filter | mg | 31.7 | 33.6 | 26.0 | 0.30 | 1433657 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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Maxxam Job #: A7D8796
Report Date: 2008/01/03

CK ENVIRONMENTAL
Client Project #: 3225
Project name: BOIMASS COMBUSTION
Sampler Initials:

## RESULTS OF ANALYSES OF IMPINGER SOLUTION

| Maxxam ID | | W41530 | W41531 | W41532 | W41533 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2007/12/06 | 2007/12/06 | 2007/12/06 | 2007/12/06 | | |
| | **Units** | **M202-A H2O/MECL2** | **M202-B H2O/MECL2** | **M202-C H2O/MECL2** | **M202-RUN 1 H2O** | **RDL** | **QC Batch** |
| Extractable Condensibles | mg | 43 | 2 | 3 | N/A | 1 | 1432143 |
| Non-Extractable Condensibles | mg | 0.9 | 1.3 | 1.4 | 7.8 | 0.5 | 1434806 |
| Volume | ml | 50 | 50 | 50 | 460 | 1 | 1433966 |
| DCM Volume | ml | 50 | 50 | 45 | N/A | 1 | 1433965 |

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

| Maxxam ID | | W41579 | W41580 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2007/12/06 | 2007/12/06 | | |
| | **Units** | **M202-RUN 2 H2O** | **M202-RUN 3 H2O** | **RDL** | **QC Batch** |
| Non-Extractable Condensibles | mg | 11 | 7.4 | 0.5 | 1434806 |
| Volume | ml | 500 | 420 | 1 | 1433966 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch



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Maxxam Job #: A7D8796
Report Date: 2008/01/03

CK ENVIRONMENTAL
Client Project #: 3225
Project name: BOIMASS COMBUSTION
Sampler Initials:

## Test Summary

**Maxxam ID** W41526 **Collected** 2007/12/06
**Sample ID** RUN 1 **Shipped**
**Matrix** Filter **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Particulates in Acetone Rinse (M5/315) | BAL | 1434814 | 2007/12/27 | 2008/01/02 | VP2 |
| Particulates on Filter (M5/315/NJATM1) | BAL | 1433657 | 2007/12/19 | 2007/12/22 | HA2 |
| Final Volume of Acetone Probe Rinse | | 1433658 | 2007/12/21 | 2007/12/27 | VP2 |

**Maxxam ID** W41527 **Collected** 2007/12/06
**Sample ID** RUN 2 **Shipped**
**Matrix** Filter **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Particulates in Acetone Rinse (M5/315) | BAL | 1434814 | 2007/12/27 | 2008/01/02 | VP2 |
| Particulates on Filter (M5/315/NJATM1) | BAL | 1433657 | 2007/12/19 | 2007/12/22 | HA2 |
| Final Volume of Acetone Probe Rinse | | 1433658 | 2007/12/21 | 2007/12/27 | VP2 |

**Maxxam ID** W41528 **Collected** 2007/12/06
**Sample ID** RUN 3 **Shipped**
**Matrix** Filter **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Particulates in Acetone Rinse (M5/315) | BAL | 1434814 | 2007/12/27 | 2008/01/02 | VP2 |
| Particulates on Filter (M5/315/NJATM1) | BAL | 1433657 | 2007/12/19 | 2007/12/22 | HA2 |
| Final Volume of Acetone Probe Rinse | | 1433658 | 2007/12/21 | 2007/12/27 | VP2 |

**Maxxam ID** W41530 **Collected** 2007/12/06
**Sample ID** M202-A H2O/MECL2 **Shipped**
**Matrix** Impinger Solution **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Extractable Condensables (M202) | | 1432143 | 2007/12/22 | 2007/12/30 | LJD |
| Non Extractable Condensibles (M202) | | 1434806 | 2007/12/27 | 2008/01/02 | VP2 |
| Volume of DCM Received | | 1433965 | 2007/12/22 | 2007/12/22 | LJD |
| Final Volume of Impinger | | 1433966 | 2007/12/22 | 2007/12/22 | LJD |

**Maxxam ID** W41531 **Collected** 2007/12/06
**Sample ID** M202-B H2O/MECL2 **Shipped**
**Matrix** Impinger Solution **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Extractable Condensables (M202) | | 1432143 | 2007/12/22 | 2007/12/30 | LJD |
| Non Extractable Condensibles (M202) | | 1434806 | 2007/12/27 | 2008/01/02 | VP2 |
| Volume of DCM Received | | 1433965 | 2007/12/22 | 2007/12/22 | LJD |
| Final Volume of Impinger | | 1433966 | 2007/12/22 | 2007/12/22 | LJD |



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Maxxam Job #: A7D8796
Report Date: 2008/01/03

CK ENVIRONMENTAL
Client Project #: 3225
Project name: BOIMASS COMBUSTION
Sampler Initials:

## Test Summary

**Maxxam ID** W41532 **Collected** 2007/12/06
**Sample ID** M202-C H2O/MECL2 **Shipped**
**Matrix** Impinger Solution **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Extractable Condensables (M202) | | 1432143 | 2007/12/22 | 2007/12/30 | LJD |
| Non Extractable Condensibles (M202) | | 1434806 | 2007/12/27 | 2008/01/02 | VP2 |
| Volume of DCM Received | | 1433965 | 2007/12/22 | 2007/12/22 | LJD |
| Final Volume of Impinger | | 1433966 | 2007/12/22 | 2007/12/22 | LJD |

**Maxxam ID** W41533 **Collected** 2007/12/06
**Sample ID** M202-RUN 1 H2O **Shipped**
**Matrix** Impinger Solution **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Non Extractable Condensibles (M202) | | 1434806 | 2007/12/27 | 2008/01/02 | VP2 |
| Final Volume of Impinger | | 1433966 | 2007/12/22 | 2007/12/22 | LJD |

**Maxxam ID** W41579 **Collected** 2007/12/06
**Sample ID** M202-RUN 2 H2O **Shipped**
**Matrix** Impinger Solution **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Non Extractable Condensibles (M202) | | 1434806 | 2007/12/27 | 2008/01/02 | VP2 |
| Final Volume of Impinger | | 1433966 | 2007/12/22 | 2007/12/22 | LJD |

**Maxxam ID** W41580 **Collected** 2007/12/06
**Sample ID** M202-RUN 3 H2O **Shipped**
**Matrix** Impinger Solution **Received** 2007/12/13

| Test Description | Instrumentation | Batch | Prepared | Analyzed | Analyst |
|---|---|---|---|---|---|
| Non Extractable Condensibles (M202) | | 1434806 | 2007/12/27 | 2008/01/02 | VP2 |
| Final Volume of Impinger | | 1433966 | 2007/12/22 | 2007/12/22 | LJD |



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Maxxam Job #: A7D8796
Report Date: 2008/01/03

CK ENVIRONMENTAL
Client Project #: 3225
Project name: BOIMASS COMBUSTION
Sampler Initials:

**GENERAL COMMENTS**

Unable to read the label on the DCM jars. Therefore the bottles are logged as A,B,C and analyzed separately for both extractable and condensible particulate. In-house RODI water was used during extraction.

**RESULTS OF ANALYSES OF FILTER**

Particulates on Filter (M5/315/NJATM1): W41526-01R*LPC*
W41527-01R*LPC*
W41528-01R*LPC*

LPC=Loose particle in container

**Results relate only to the items tested.**



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CK ENVIRONMENTAL
Attention: Kevin Kelley
Client Project #: 3225
P.O. #:
Project name: BOIMASS COMBUSTION

## Quality Assurance Report

Maxxam Job Number: GA7D8796

| QA/QC Batch Num Init | QC Type | Parameter | Date Analyzed yyyy/mm/dd | Value | %Recovery | Units | QC Limits |
|---|---|---|---|---|---|---|---|
| 1432143 LJD | Spiked Blank | Extractable Condensibles | 2007/12/30 | 110, RDL=1 | 108 | mg | 70 - 130 |
| | Spiked Blank DUP | Extractable Condensibles | 2007/12/30 | 110, RDL=1 | 105 | mg | 70 - 130 |
| | Method Blank | Extractable Condensibles | 2007/12/30 | ND, RDL=1 | -- | mg | |
| 1434806 VP2 | Method Blank | Non-Extractable Condensibles | 2008/01/02 | ND, RDL=0.5 | | mg | |
| 1434814 VP2 | Method Blank | Particulate Weight in Acetone Rinse | 2008/01/02 | ND, RDL=0.5 | | mg | |

ND = Not detected
SPIKE = Fortified sample



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## Validation Signature Page

**Maxxam Job #: A7D8796**

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

FRANK MO, B.Sc., Inorganic Lab. Manager

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CAEAL have approved this reporting process and electronic report format.



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# CK ENVIRONMENTAL, INC.

1020 Turnpike Street, Suite 8 Canton, Massachusetts 02021
Phone 781.828-5200 Fax 781.828-5380

## CHAIN OF CUSTODY DOCUMENT



| | | | | |
|---|---|---|---|---|
| **CK Client Name:** | BioMass Combustion | **Project Location** | **CK P.O. No.:** | **Laboratory** |
| **Project Name:** | | Boston Sash | **Sample Date(s):** 12/6/2007 | Maxxam Analytical |
| **CK Project No.:** | 3225 | Dighton, MA | **Date Shipped:** 12/12/2007 | |
| **CK Project Manager:** | Kevin Kelley | | **Cooler No.:** N/A | |
| **CK Field Team:** | Kevin Kelley | | **COC Seal No.:** N/A | **Attn: Sample Custodian** |
| **Turnaround Time (Please Circle):** | **Rush** | **Priority** | **Standard** | **Other:** _____ | |

| Item | Sample ID Code | Date | Volume | Sample Location | Sample Fraction | Sample Matrix | Analytical Parameters | Special Instructions |
|---|---|---|---|---|---|---|---|---|
| 1 | Run 1 | 12/06/07 | | | Filter #2006090606 | | PM by EPA M5 | |
| 2 | Run 1 | 12/06/07 | | | P&N rinse | acetone | PM by EPA M5 | |
| 3 | Run 1 | 12/06/07 | | | Impinger Catch & Rinse | DI water | CPM by EPA 202 | |
| 4 | Run 1 | 12/06/07 | | | MeCl2 Rinse | MeCl2 | CPM by EPA 202 | |
| 5 | Run 2 | 12/06/07 | | | Filter #2006090604 | | PM by EPA M5 | |
| 6 | Run 2 | 12/06/07 | | | P&N rinse | acetone | PM by EPA M5 | |
| 7 | Run 2 | 12/06/07 | | | Impinger Catch & Rinse | DI water | CPM by EPA 202 | |
| 8 | Run 2 | 12/06/07 | | | MeCl2 Rinse | MeCl2 | CPM by EPA 202 | |
| 9 | Run 3 | 12/06/07 | | | Filter #2006090605 | | PM by EPA M5 | |
| 10 | Run 3 | 12/06/07 | | | P&N rinse | acetone | PM by EPA M5 | |
| 11 | Run 3 | 12/06/07 | | | Impinger Catch & Rinse | DI water | CPM by EPA 202 | |
| 12 | Run 3 | 12/06/07 | | | MeCl2 Rinse | MeCl2 | CPM by EPA 202 | |

Field Notes and Misc. Comments:

Sign & date C-O-C form and return original copy with final data report.

| | | | |
|---|---|---|---|
| Relinquished by (Print Name): **Kevin Kelley** | Date: 12/12/2007 | Received by: FEDEX | Date: 12/12/2007 |
| Signature: | Time: | Fed. Ex. Office: / Tel #: / Tracking #: | Time: Hrs |
| Relinquished by: FEDEX / Fed. Ex. Office: / Tracking #: | Date: / Time: | Received by Lab (Print Name): / Signature: | Date: / Time: |

Analytical Laboratory Notes:
COC Seal Intact: ☐ Yes ☐ No
Cooler Temperature: _____ Degrees F
Comments:

WHITE COPY - ORIGINAL COPY (Completed copy to be returned with Final Report) YELLOW COPY - LABORATORY COPY PINK COPY - ORIGINATOR / CK PROJECT FILE COPY