



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 (NO<sub>x</sub>), 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. NO<sub>x</sub> 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 (O <sub>2</sub> ) and Carbon Dioxide (CO <sub>2</sub> ) Concentration Emissions from Stationary Sources
EPA Method 7E	- Determination of Nitrogen Oxide (NO <sub>x</sub> ) 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



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](mailto:kkelley@ckenvironmental.com)) should you have any questions regarding the performance, or finding, of this testing program.

Sincerely,

Kevin J. Kelley  
Program Manager



Table 1 – Summary of Results

TEST NUMBER: DATE: START TIME :		1 12/6/2007 0951	2 12/6/2007 1133	3 12/6/2007 1420	AVERAGE
<b>PROCESS CONDITIONS</b>	<b>UNITS</b>				
Wood Feed Rate	lb/hr	120	107	107	111
<b>SAMPLE CONDITIONS</b>					
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	-
<b>STACK CONDITIONS</b>					
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
CO <sub>2</sub> in Stack Gas	%	3.9	2.4	2.6	3.0
O <sub>2</sub> in Stack Gas	%	16.6	18.3	17.9	17.6
CO in Stack Gas	ppm	315	485	205	335
<b>MEASURED EMISSIONS</b>					
NO <sub>x</sub> in Stack Gas	ppm	14.1	9.1	11.0	11.4
NO <sub>x</sub> Emission Rate	lbs/hr	0.059	0.038	0.046	0.048
<b>NO<sub>x</sub> Emission Rate</b>	<b>lb/MMBtu</b>	<b>0.058</b>	<b>0.042</b>	<b>0.050</b>	<b>0.050</b>
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
<b>Particulate Emissions</b>	<b>lb/MMBtu</b>	<b>0.086</b>	<b>0.097</b>	<b>0.077</b>	<b>0.086</b>



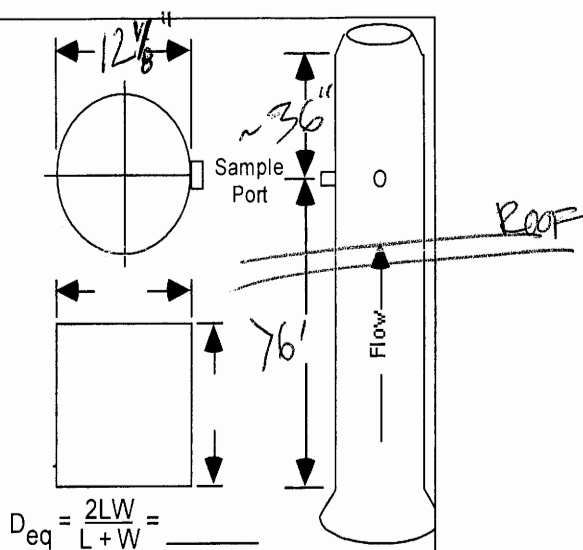
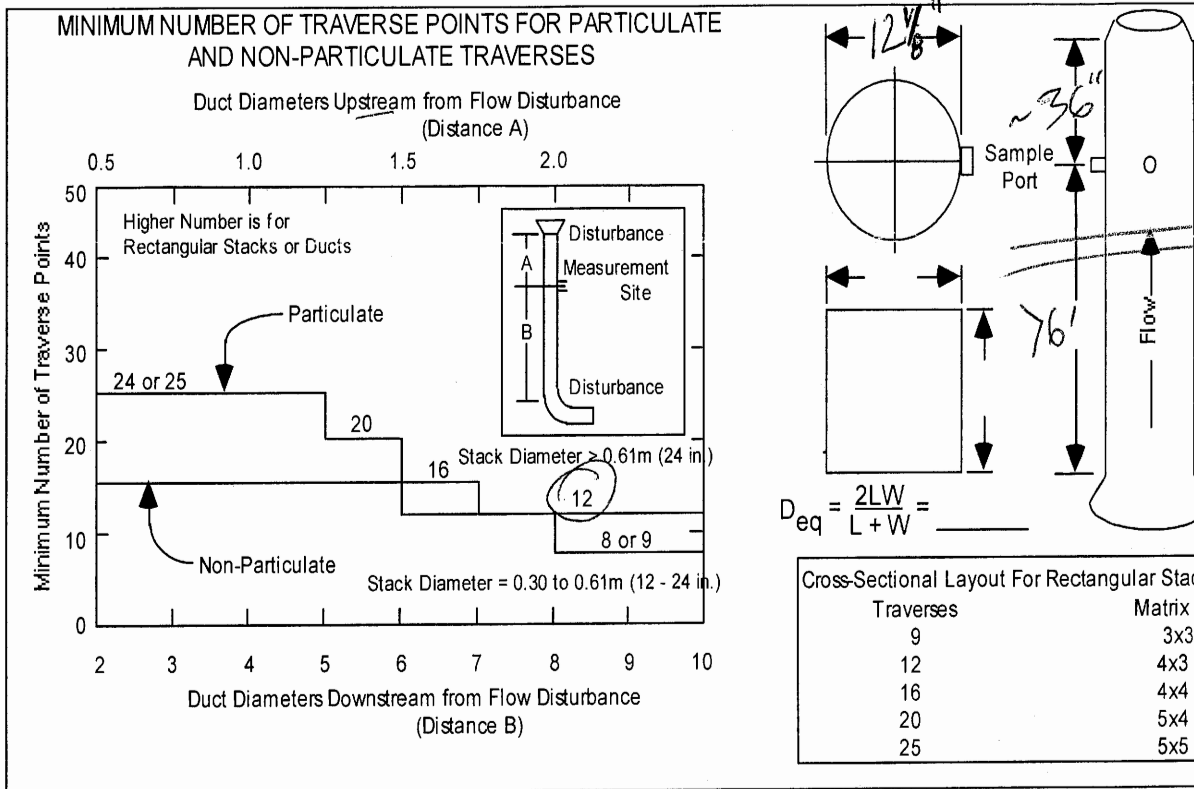
**APPENDIX A**

**FIELD DATA SHEETS**

# EPA Method 1

Sample and Velocity Traverses  
for Stationary Sources

Firm BIOMASS COMBUSTION @ BOSTON ASHT Total Traverse Points Required 12  
 Date 12/5/07 Project No. \_\_\_\_\_ Number of Ports \_\_\_\_\_  
 Location WOOD-FIRED FURNACE STACK Points Per Port 2  
 Diameters Upstream 3 Probe Traverses: Horizontal \_\_\_\_\_  
 Diameters Downstream 76 Vertical \_\_\_\_\_



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



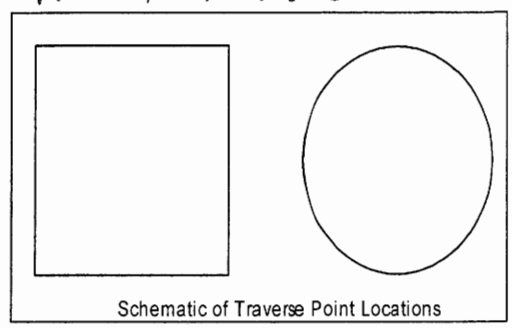
ESZ 1.6676  
 AHE +0.0898  
 Y = 0.9942  
 1.0083

# EPA Method 2

Velocity Traverse and  
 Flow Rate Determination

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<sup>2</sup>  
**Rectangular Stack or Duct:**  
 Stack Length (in) \_\_\_\_\_ Area \_\_\_\_\_ ft<sup>2</sup>  
 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: \_\_\_\_\_

Pre-test flow



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				
<b>AVERAGE</b>							<b>AVERAGE</b>	

Absolute Gas Temperature;  $T_{st} = T_s + 460^\circ$   
 Absolute Gas Pressure;  $P_s = P_b + P_g/13.6$   
 Gas Velocity;  $V_s = (85.49)C_p(??P*cosØ)_{avg}(T_{st} avg/(P_s*M_w))$   
 Actual Gas Flow Rate;  $Q_a = (V_s)(60)(A)$   
 Standard Gas Flow Rate;  $Q_s = Q_a(528^\circ R/T_{st})(P_s/29.92)$   
 Dry Standard Gas Flow Rate;  $Q_{sd} = Q_a(528^\circ R/T_{st})(P_s/29.92)((100-\%H_2O)/100)$

\_\_\_\_\_ ° R  
 \_\_\_\_\_ in. Hg  
 \_\_\_\_\_ ft/sec  
 #VALUE! acfm  
 \_\_\_\_\_ scfm  
 \_\_\_\_\_ dscfm

Particulate Test Data Worksheet

CLIENT: BioMass Combustion SOURCE/LOCATION: Boston Sash PROJECT NUMBER: 3225 TEST NUMBER: DATE: TIME :			1 6-Dec-07 0950-1050	2 6-Dec-07 1133-1233	3 6-Dec-07 1420-1520	AVERAGE
TEST DATA INPUT	SYMBOL	UNITS				
Barometric Pressure	Pbar	in. Hg	30.00	30.24	30.25	
Stack Area	A	ft <sup>2</sup>	0.80	0.80	0.80	
Nozzle Diameter (in.)	Dn	in.	0.441	0.441	0.441	
Total Sampling Time	∅	min.	60	60	60	
Calibration Factor	Y	-	1.008	1.008	1.008	
Pitot Coefficient	Cp	-	0.84	0.84	0.84	
Average Square Root of Velocity Head	Sq Rt dPavg	in. H <sub>2</sub> O	0.244	0.249	0.240	
Average Orifice Pressure Drop	?H	in. H <sub>2</sub> O	1.75	1.82	1.69	
Average Meter Temperature	Tm	°F	42	49	45	
Average Stack Pressure	Pg	in. H <sub>2</sub> O	0.06	0.06	0.06	
Average Stack Temperature	Ts	°F	198	201	175	
Meter Volume @ Meter Conditions	Vm	ft <sup>3</sup>	42.62	43.63	41.99	
Total Water Collected	Vlc	ml	24.7	32.9	31.0	
CO <sub>2</sub> in Stack Gas	CO <sub>2</sub>	%	3.9	2.4	2.6	
O <sub>2</sub> in Stack Gas	O <sub>2</sub>	%	16.6	18.3	17.9	
CO in Stack Gas	CO	%	0	0	0	
Filter			31.7	33.6	26.0	
Front-half rinse			8.7	4.0	3.9	
Condensibles			11.7	14.9	11.3	
Total Particulate Catch	Pmt	mg	52.1	52.5	41.2	
FUEL						
Hydrogen in Fuel	H <sub>2</sub>	%				
Carbon in Fuel	C	%				
Sulfur in Fuel	S <sub>2</sub>	%				
Nitrogen in Fuel	N <sub>2</sub>	%				
Oxygen in Fuel	O <sub>2</sub>	%				
Gross Calorific Volume of Fuel	HHV	Btu/lb				
CALCULATED VALUES						
Meter Volume	Vmstd	dscf	45.50	46.31	44.93	45.58
Water Vapor in Stack Gas	Bws	%	2.5	3.2	3.1	3.0
Molecular Weight of Stack Gas (dry)	Md	g/g-mole	29.29	29.12	29.13	29.18
Molecular Weight of Stack Gas (wet)	Ms	g/g-mole	29.01	28.76	28.78	28.85
Average Velocity of Stack Gas	Vs	ft/min	914	935	883	911
Actual Stack Gas Flowrate	Q	acf/min	733	750	708	730
	Qs	scf/min	590	606	595	597
Stack Gas Flowrate	Qsd	dscf/min	575	586	577	579
Isokinetics	I	%	99.7	99.6	98.2	-
EMISSION CONCENTRATION						
Particulate Emission Concentration	PCgr	gr/acf	0.01	0.01	0.01	0.01
Particulate Emission Concentration	PCgrsd	gr/dscf	0.018	0.017	0.014	0.016
Particulate Emission Concentration	PClbsd	lb/dscf	2.52E-06	2.50E-06	2.02E-06	2.35E-06
Particulate Emission Concentration	PCµgm	µg/dscm	40.461	40.057	32.406	37.641
EMISSION RATE						
Particulate Emission Rate	PER	lb/hr	0.087	0.088	0.070	0.082

# EPA Method 5

Particulate Test Data Sheet

Client/Firm: BIO MASS COMBUSTION  
 Location: WOODFORD GREEN STARK  
 Project No.: 1  
 Test Number: 1  
 Test Date: 12/6/07  
 Start Time: 04:51  
 End Time: 5  
 Testers Initials: 62  
 Min Per Point: 5

Assumed Moisture: 5 (%)  
 Pb = 0.441 (in Hg)  
 Nozzle Size: 0.441  
 Nozzle No.: J55006  
 C/K Factor: 29.14

Module No.: ESL  
 dH@ = 1.0676  
 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<sup>2</sup>) 116.00  
 Train Leak Checks: Pre-Test 0.01 cfm Post-Test 10 in Hg  
 Orsat Leak Check: Pre-Test          Post-Test           
 Pitot Leak Check: Pre-Test          Post-Test           
 Final Orsat Analysis 02% CO2%

Port	Point	Time (min)	Meter Volume (ft <sup>3</sup> )	dP (in. H2O)	dH (in. H2O)	Stack (°F)	Probe (°F)	Htr Box (°F)	Temperatures		Cond. Out (°F)	Module Meter		Vacuum (in. Hg)	Comments
									Filter (°F)	Out (°F)		In (°F)	Out (°F)		
A	1	0	271.28	0.01	2.04	342	337	212	29	40	34	2	Static Pressure: <u>dp</u>	in H2O	
	2	5	275.4	0.07	2.04	335	239	232	34	43	35	3	<u>0.045</u>	<u>1.31</u>	
	3	10	279.0	0.60	1.89	226	237	234	36	44	36	3	<u>0.05</u>	<u>1.46</u>	
	4	15	283	0.60	1.75	204	237	230	39	46	37	3	<u>0.055</u>	<u>1.60</u>	
	5	20	286.4	0.55	1.6	184	236	236	41	46	38	3	<u>0.06</u>	<u>1.75</u>	
	6	25	289.4	0.05	1.46	93	239	237	42	47	39	3	<u>0.065</u>	<u>1.89</u>	
	30	30	143												
B	1			0.05	1.46	93	237	236	44	47	39	3	<u>0.07</u>	<u>2.04</u>	
	2		246.2	0.05	1.46	162	239	237	44	47	39	3	<u>0.075</u>	<u>2.19</u>	
	3		299.5	0.55	1.6	184	239	236	46	49	40	3			
	4		302.6	0.06	1.75	334	239	237	48	49	46	3			
	5		306	0.07	2.04	270	239	237	48	49	41	6			
	6		310.0	0.07	2.04	270	240	240	52	51	43	6			
	END		313.911												

Final Reading:          Average

Total Volume:          Avg Square Root dP

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

Average of In & Out Meter Temperatures

Total Moisture Catch:         

Calculated Moisture Content: 21.7



# EPA Method 5

Particulate Test Data Sheet

BIO MASS COMBUSTION  
@ BOSTON SASH

Client/Firm: WOOD FIBER FURNACE STACK  
 Location: WOOD FIBER FURNACE STACK  
 Project No.: 2  
 Test Number: 2  
 Test Date: 12/6/07  
 Start Time: 11:33  
 End Time: 11:48  
 Resters Initials: JK  
 Nozzle Size: 0.441  
 Nozzle No.: 155006  
 C/K Factor: 29.14

Assumed Moisture:           
 Pb =           
 Module No.: ESZ  
 dH@ = 166.76  
 Cp = 0.824  
 Y = 1.0080  
 Probe No.: M5-16  
 Pitot No.:           
 Filter No.: Z0060910604

## Signature of Train Operator:

Rectangular Stack: Length (in)          Width (in)           
 Circular Stack: Diameter (in) 12.125 Area (ft<sup>2</sup>) 0.00  
 Train Leak Checks: Pre-Test 0.01 cfm Post-Test 17 in Hg  
 Orsat Leak Check: Pre-Test          Post-Test           
 Pitot Leak Check: Pre-Test          Post-Test           
 Final Orsat Analysis: 02% CO2%

Port Point	Time (min)	Meter Volume (ft <sup>3</sup> )	dP (in. H2O)	dH (in. H2O)	Temperatures				Cond Out (°F)	Module Meter		Vacuum (in. Hg)	Comments
					Stack (°F)	Probe (°F)	Htr Box (°F)	Filter (°F)		In (°F)	Out (°F)		
1	0	314.257	0.07	2.04	255	210	37	47	44	5	Static Pressure: in H2O		
2	5	318.1	0.07	2.04	254	232	41	49	44	6			
3	10	321.9	0.07	2.04	255	236	43	51	44	7	DP		
4	11:48 15	325.8	0.06	1.75	253	236	44	51	45	6	0.045	1.31	
5	11:52 20	329.4	0.06	1.75	254	239	46	52	46	6	0.05	1.46	
6	11:58 25	332.9	0.05	1.46	255	236	49	52	46	5	0.55	1.60	
7	12:03 30	336.3	0.05	1.46	257	237	51	52	46	5	0.6	1.75	
8	12:08 35	339.4	0.05	1.46	255	240	52	52	47	6	0.65	1.89	
9	12:13 40	342.6	0.06	1.75	257	239	54	53	47	8	0.7	2.04	
10	12:18 45	346.2	0.07	2.04	257	234	55	53	47	9	0.75	2.19	
11	12:23 50	350.1	0.07	2.04	257	246	55	53	47	10			
12	12:28 55	354.0	0.07	2.04	257	240	58	54	48	10			
END	12:33 00	357.854											

Impinger Number	Impinger Recovery		Total Catch
	Vol. or Wt. Initial	Vol. or Wt. Final	
1	679.6	482.1	2.5
2	689.8	704.1	14.5
3	506.6	530.7	4.1
4			
Other(s)			
Silica Gel	816.3	816.3	12

Final Reading:          Average of In & Out Meter Temperatures           
 Total Volume:          Avg Square Root dP           
 Total Moisture Catch:          Calculated Moisture Content: 32.9  
 Rev 9/95 TMC

# EPA Method 5

Particulate Test Data Sheet

## Signature of Train Operator:

Rectangular Stack: Length (in) \_\_\_\_\_ Width (in) \_\_\_\_\_  
 Circular Stack: Diameter (in) 12.125 Area (ft<sup>2</sup>) 0.00  
 Train Leak Checks: Pre-Test 0 cfm Post-Test 10 in Hg  
 Orsat Leak Check: Pre-Test 0 cfm Post-Test 12 in Hg  
 Pitot Leak Check: Pre-Test \_\_\_\_\_ Post-Test \_\_\_\_\_  
 Final Orsat Analysis 02% CO2%

## Module No. ES2

dH@ = 1.676  
 Cp = 0.84  
 Y = 1.0080  
 Probe No. M5-10  
 Pitot No. \_\_\_\_\_  
 Filter No. 200601005

## Assumed Moisture

Pb = \_\_\_\_\_  
 Nozzle Size 0.441  
 Nozzle No. 155016  
 C/K Factor 29.14

## Client/Firm

Location BIO MASS COMBUSTION @ BOSTON SOUTH  
 Project No. 11000-firco furnace SPKX  
 Test Number 3  
 Test Date 12/6/07  
 Start Time 1420  
 End Time \_\_\_\_\_  
 Testers Initials WK  
 Min Per Point 5

Port	Point	Time (min)	Meter Volume (ft <sup>3</sup> )	dP (in H2O)	dH (in H2O)	Stack (°F)	Probe (°F)	Temperatures			Vacuum (in. Hg)	Comments	
								Htr Box (°F)	Filter (°F)	Cond Out (°F)			
A	1	1420	358.052	0.63	1.89	194	253	218	36	42	42	4	Static Pressure: in H2O
	2	1425	361.8	0.60	1.75	197	254	232	39	44	42	4	
	3	1430	365.3	0.60	1.75	219	253	234	42	46	41	4	dH
	4	1435	368.9	0.60	1.75	202	253	234	42	47	41	4	0.45
	5	1440	372.4	0.50	1.46	158	255	236	40	49	42	4	0.50
	6	1445	375.7	0.45	1.31	74	255	236	47	49	42	4	0.55
	6	1450	378.9	0.45	1.31	65	254	240	48	49	43	4	0.60
	5	1455	382.0	0.5	1.46	98	253	237	50	49	43	5	0.65
	4	1505	385.7	0.55	1.6	172	256	237	53	49	43	5	0.70
	3	1505	388.6	0.65	1.89	233	255	234	57	50	43	7	0.75
	2	1510	392.3	0.70	2.04	249	226	233	59	51	44	8	
	1	1515	396.1	0.70	2.04	235	254	232	59	51	44	8	
	END	1720	400.044										
Average												Average of In & Out Meter Temperatures	
Final Reading:													
Total Volume:													

Impinger Number	Vol or Wt		Total Catch
	Initial	Final	
1	715.6	715.7	8.1
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

Total Moisture Content: 31.5

Total Moisture Catch: \_\_\_\_\_



WOOD WAD

Run 1 = 20 lb/10 min

Run 2+3 = 17 lb/10 min

**SYSTEM CALIBRATION SHEET**

PLANT: BOSTON SASH/BIO MASS COMB DATE: 12/6/07  
 TEST LOCATION: BIO MASS BUR OPERATOR: MK  
 FUEL: WOOD SYSTEM RESPONSE TIME: \_\_\_\_\_

		O <sub>2</sub>		CO <sub>2</sub>		CO		SO <sub>2</sub>		NO <sub>x</sub>	
		RANGE: ZERO	SPAN	RANGE: ZERO	SPAN	RANGE: ZERO	SPAN	RANGE: ZERO	SPAN	RANGE: ZERO	SPAN
RUN: <u>1</u> START TIME: <u>09:50</u> END TIME: <u>10:50</u>	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	<del>2.4</del>	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: <u>2</u> START TIME: <u>11:33</u> END TIME: <u>12:33</u>	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: <u>3</u> START TIME: <u>14:20</u> 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



## ANALYZER CALIBRATION SHEET

PLANT: Biomass Comb @ Boston SASH      DATE: 12/6/07  
 TEST LOCATION: Biomass BLR                      OPERATOR: MK  
 FUEL: WOOD

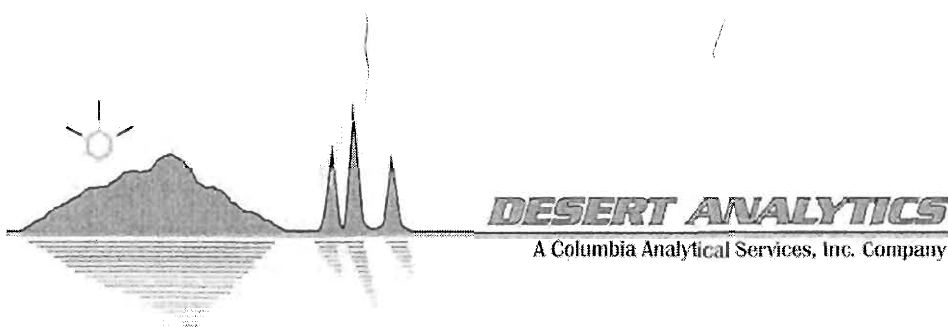
GAS	RANGE	CYLINDER VALUE	ANALYZER RESPONSE	ABSOLUTE DIFFERENCE	ANALYZER CAL. ERROR
O <sub>2</sub>	ZERO	0.0	0.1	0.1	0.4
	MID	10.96	11.1	0.1	0.4
	HIGH	21.1	21.0	0.1	0.4
CO <sub>2</sub>	ZERO	0.0	0.0	0.0	0.0
	MID	11.12	<del>17.6</del> <sup>11.2</sup>	0.1	0.5
	HIGH	17.6	17.6	0.0	0.0
CO	ZERO	0.0	0.1	0.1	0.0
	MID	292	292	0.0	0.0
	HIGH	496	492.0	4.0	0.8
SO <sub>2</sub>	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 CALIBRATION ERROR = [(ANALYZER RESPONSE - CYLINDER VALUE) / HIGH CYLINDER VALUE] \* 100

ERROR MUST NOT EXCEED 2% OF HIGH CYLINDER VALUE



**APPENDIX B**  
**LABORATORY REPORT**



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:

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 Condensables (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.

..12

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



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						

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		
	<b>Units</b>	<b>M202-A H2O/MECL2</b>	<b>M202-B H2O/MECL2</b>	<b>M202-C H2O/MECL2</b>	<b>M202-RUN 1 H2O</b>	<b>RDL</b>	<b>QC Batch</b>

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		
	<b>Units</b>	<b>M202-RUN 2 H2O</b>	<b>M202-RUN 3 H2O</b>	<b>RDL</b>	<b>QC Batch</b>

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

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 Condensables (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 Condensables (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 Job #: A7D8796  
Report Date: 2008/01/03

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

**Test Summary**

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

Test Description	Instrumentation	Batch	Prepared	Analyzed	Analyst
Extractable Condensables (M202)		1432143	2007/12/22	2007/12/30	LJD
Non Extractable Condensables (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  
**Sample ID** M202-RUN 1 H2O  
**Matrix** Impinger Solution  
**Collected** 2007/12/06  
**Shipped**  
**Received** 2007/12/13

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

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

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

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

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

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.**

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

**Validation Signature Page**

**Maxxam Job #: A7D8796**

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



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

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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. ...



**CK ENVIRONMENTAL, INC.**  
 1020 Turnpike Street, Suite 8 Canton, Massachusetts 02021  
 Phone 781.828-5200 Fax 781.828-5380

**CHAIN OF CUSTODY DOCUMENT**

<b>CK Client Name:</b> BioMass Combustion	<b>Project Location</b>	<b>CK P.O. No.:</b>	<b>Laboratory</b>
<b>Project Name:</b>	Boston Sash	<b>Sample Date(s):</b> 12/6/2007	Maxxam Analytical
<b>CK Project No.:</b> 3225	Dighton, MA	<b>Date Shipped:</b> 12/12/2007	
<b>CK Project Manager:</b> Kevin Kelley		<b>Cooler No.:</b> N/A	
<b>CK Field Team:</b> Kevin Kelley		<b>COC Seal No.:</b> N/A	<b>Attn:</b> Sample Custodian
<b>Turnaround Time (Please Circle):</b> 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): <b>Kevin Kelley</b>	Date: 12/12/2007	Received by: FEDEX	Date: 12/12/2007
Signature: <i>Kevin Kelley</i>	Time:	Fed. Ex. Office:	Time: Hrs
Relinquished by: FEDEX	Date:	Tel #:	Time: Hrs
Fed. Ex. Office:	Time:	Tracking #:	Time: Hrs
Tracking #:	Date:	Received by Lab (Print Name):	Date:
	Time:	Signature:	Time:

Analytical Laboratory Notes:  
 COC Seal Intact:  Yes  No  
 Cooler Temperature: \_\_\_\_\_ Degrees F  
 Comments: