

Air Emissions Test, The Metropolitan District, Hartford, CT

Craig E. Scott, P.E.
Facility Engineer 3
The Metropolitan District

3/31/2010

Leigh Gammie
Program Manager
Gammie Air Monitoring, LLC.

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

MDC - Hartford Water Pollution Control Fa
240 Brainard Road

Gammie Air Monitoring LLC
28 Canton Road

Hartford CT 06114

Craig Scott
860-278-7850 x3451
860-251-6141
cscott@themdc.com

West Simsbury CT 06092

Leigh Gammie
860-658-4929
860-658-2223
lag@gamair.com

56221

0900303405

<http://www.epa.gov/envi>

075-505-0007

0007

SSI #2

2.5 dry tons per hour

2.0 dry tons per hour

2.25 dry tons per hour

50100515

Waste Disposal - Solid Waste Disposal - Government - Other Incineration - Sludge:
Multiple Hearth

40 CFR 60 Subpart 503	Total Particulate	1.3	lb/dry ton of sludge
-----------------------	-------------------	-----	-------------------------

The Sewage Sludge Incinerator Nos. 1 and 2 are similar in design and operations. Biosolids are fed continuously to each unit at a maximum rate of 2.5 dry tons per hour. For the purposes of this test program each unit will operate at greater than 90% of maximum capacity rating which equates to greater than 2.25 dry tons per hour. Supplemental fuel (natural gas or propane), when required, is provided on hearths 2, 5, 7, and 9 by three burners per hearth. Air emissions generated within each incinerator are controlled by zero hearth afterburners, operating above 1200oF, followed by a wet scrubber Venturi Pak system manufactured by EnviroCare, Inc. The venturi scrubber operates at a minimum pressure drop of 20 inches of water column (inches w.c.) and the tray water flowrates operate at a minimum of 550 gallons per minute. Each incinerator is also equipped with flue gas recirculation (FGR). FGR combustion gases are withdrawn from the third hearth and reintroduced into the ninth and tenth hearths. Stack exhaust gas volumetric flowrate ranges between 15,000 and 18,500 actual cubic feet per minute (acfm) at 100oF depending on the biosolids feed rate.

Stack Exit	60	0	0	0	120	324	2	12
------------	----	---	---	---	-----	-----	---	----

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

Stack Exit	Total Particulate	OTM - 27/28	3	90	0	Use only for dry stacks. Delete Method 5/OTM28 tests.
Stack Exit	Total PM2.5	OTM - 27/28	3	90	0	Use only for dry stacks. Delete Method 5/OTM28 tests.
Stack Exit	Organic Condensible Particulate	OTM - 27/28	3	90	0	Use only for dry stacks. Delete Method 5/OTM28 tests.
Stack Exit	Inorganic (Aqueous) Condensible Part.	OTM - 27/28	3	90	0	Use only for dry stacks. Delete Method 5/OTM28 tests.
Stack Exit	Filterable PM2.5	OTM - 27/28	3	90	0	Use only for dry stacks. Delete Method 5/OTM28 tests.
Stack Exit	Filterable Particulate	OTM - 27/28	3	90	0	Use only for dry stacks. Delete Method 5/OTM28 tests.

EPA Other Test Method 27 will be used in sampling for PM2.5. Twelve sample/traverse points will be used as described in the method. For sample point 6 (2.6 inches from inside wall) the majority of the PM2.5 instack sampler will be outside of the stack. To maintain the sampler at stack temperature (~120 deg F) an external heater was added to maintain the required probe and cyclone temperature.

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

Stack Exit - OTM - 27/28

Run Number	1	2	3	
Test Date	2/11/2010	2/11/2010	2/11/2010	
Run Start Time	8:51:00 AM	2:30:00 PM	5:15:00 PM	
Run Finish Time	10:46:00 AM	4:27:00 PM	7:09:00 PM	
Net Run Time, minutes	112	114.8	112.5	
Dry Gas Meter Volume Sampled, dscf	42.857	43.276	42.578	42.904
Moisture Content of Stack Gas, %	2.03	4.16	1.84	2.677
Carbon Dioxide, %	6.5	7.4	7.7	7.200
Oxygen, %	12.5	12	11.8	12.100
Average Stack Gas Temperature, °F	92.42	93.58	95.08	93.693
Dry Volumetric Flow Rate, dry scfm	18,077.7	17,488.7	18,123.4	17,896.600
Actual Wet Volumetric Flue Gas Flow Rate, acfm	19,627.1	19,450.4	19,733.2	19,603.567
Percent Isokinetic of Sampling Rate, %	101.5	103.4	100.1	101.667
F-Factor, dscfm/MMBtu @ %O ₂	0	0	0	0.000
Fw	0	0	0	0.000
Fc	0	0	0	0.000

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

Stack Exit - OTM - 27/28

Filterable Particulate

RunNumber	1	2	3	
Mass_mg	4.25	4.55	4.8	4.533
Elb/hr	2.37E-01	2.43E-01	2.70E-01	0.250
mg/dscm	3.50E+00	3.71E+00	3.98E+00	3.730
mg/dscm@7%O2	5.79E+00	5.79E+00	6.08E+00	5.887

Filterable PM2.5

RunNumber	1	2	3	
Mass_mg	3.5	4.45	4.5	4.150
Elb/hr	1.95E-01	2.38E-01	2.53E-01	0.229
mg/dscm	2.88E+00	3.63E+00	3.73E+00	3.413
mg/dscm@7%O2	4.77E+00	5.67E+00	5.70E+00	5.380

Inorganic (Aqueous) Condensable Pa

RunNumber	1	2	3	
Mass_mg	2.9	3.7	6	4.200
Elb/hr	1.62E-01	1.98E-01	3.38E-01	0.233
mg/dscm	2.39E+00	3.02E+00	4.98E+00	3.463
mg/dscm@7%O2	3.95E+00	4.72E+00	7.61E+00	5.427

Organic Condensable Particulate

RunNumber	1	2	3	
Mass_mg	5.7	3.2	3.8	4.233
Elb/hr	3.18E-01	1.71E-01	2.14E-01	0.234
mg/dscm	4.70E+00	2.61E+00	3.15E+00	3.487
mg/dscm@7%O2	7.78E+00	4.08E+00	4.81E+00	5.557

Total Particulate

RunNumber	1	2	3	
Mass_mg	10.85	9.45	12.6	10.967
Elb/hr	6.05E-01	5.05E-01	7.09E-01	0.606
mg/dscm	8.94E+00	7.71E+00	1.05E+01	9.050
mg/dscm@7%O2	1.48E+01	1.20E+01	1.60E+01	14.267

Total PM2.5

RunNumber	1	2	3	
Mass_mg	10.1	9.35	12.3	10.583
Elb/hr	5.64E-01	5.00E-01	6.93E-01	0.586
mg/dscm	8.32E+00	7.63E+00	1.02E+01	8.717
mg/dscm@7%O2	1.38E+01	1.19E+01	1.56E+01	13.767

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

1	Dried Sludge Feedrate	2.14	Tons/hr	2.25
2	Dried Sludge Feedrate	2.19	Tons/hr	2.25
3	Dried Sludge Feedrate	2.27	Tons/hr	2.25
1	Incinerator Afterburner Gas Temp	1320	deg F	1290
2	Incinerator Afterburner Gas Temp	1356	deg F	1290
3	Incinerator Afterburner Gas Temp	1367	deg F	1290
1	Scrubber Pressure Drop	29.7	in H2O	29
2	Scrubber Pressure Drop	29.5	in H2O	29
3	Scrubber Pressure Drop	30	in H2O	29
1	Scrubber Water Flowrate	1272.9	Gal/min	1250
2	Scrubber Water Flowrate	1244.5	Gal/min	1250
3	Scrubber Water Flowrate	1246.9	Gal/min	1250
1	Gas Firing Rate	67.55	Ft^3/min	58
2	Gas Firing Rate	102.72	Ft^3/min	58
3	Gas Firing Rate	56.25	Ft^3/min	58
1	Oxygen Content at Incinerator exhaust	3.4	%	0
1	Oxygen Content at Incinerator exhaust	3.4	%	5.9
1	Average Hearth Temperature	1210	F	1200
1	Scrubber Outlet Temperature	0	F	120
1	FLUE GAS RECIRCULATION	0		0
2	FLUE GAS RECIRCULATION	0		0
3	FLUE GAS RECIRCULATION	0		0
1	VENTURI SCRUBBER	1272.9	gpm	1250
2	VENTURI SCRUBBER	1244.6	gpm	1250
3	VENTURI SCRUBBER	1246.9	gpm	1250
1	AFTERBURNER	1320	deg F	1200
2	AFTERBURNER	1356	deg F	1200
3	AFTERBURNER	1367	deg F	1200
1	WATER SPRAYS	0	gpm	200
2	WATER SPRAYS	0	gpm	200

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

3	WATER SPRAYS	0	gpm	200
1	MIST ELIMINATOR - HIGH EFFICIENCY	0		0
2	MIST ELIMINATOR - HIGH EFFICIENCY	0		0
3	MIST ELIMINATOR - HIGH EFFICIENCY	0		0

1	Sludge moisture content	72.5	%	
1	Ultimate/Proximate Analysis	8300		
1	Scrubber Water Discharge pH	0	pH	
1	Total Dissolved Solids	636	mg/L	
1	Total Suspended Solids	110	mg/L	
2	Sludge moisture content	73.8	%	
2	Ultimate/Proximate Analysis	8210		
2	Scrubber Water Discharge pH	0	pH	
2	Total Dissolved Solids	709	mg/L	
2	Total Suspended Solids	84	mg/L	
3	Sludge moisture content	73.9	%	
3	Ultimate/Proximate Analysis	8410		
3	Scrubber Water Discharge pH	0	pH	
3	Total Dissolved Solids	845	mg/L	
3	Total Suspended Solids	74	mg/L	

Air Emissions Test, The Metropolitan District, Hartford, CT

3/31/2010

Stack Exit - OTM - 27/28

Run Number	1	2	3	
Test Date	2/11/2010	2/11/2010	2/11/2010	
Run Start Time	8:51:00 AM	2:30:00 PM	5:15:00 PM	
Run Finish Time	10:46:00 AM	4:27:00 PM	7:09:00 PM	
Net Traversing Points	12	12	12	
Net Run Time, minutes	112	114.8	112.5	
Nozzle Diameter, inches	0.274	0.274	0.274	0.274
Pitot Tube Coefficient	0.84	0.84	0.84	0.840
Dry Gas Meter Calibration Factor	0.988	0.988	0.988	0.988
Barometric Pressure, inches of Mercury	29.44	29.44	29.44	29.440
Average Orifice Meter Differential, inches H2O	0.45	0.45	0.45	0.450
Dry Gas Meter Volume Sampled, cubic feet	44.300	44.957	44.232	44.496
Average Dry Gas Meter Temperature, °F	71.17	73.83	73.83	72.943
Dry Gas Meter Volume Sampled, dscf	42.857	43.276	42.578	42.904
Total Moisture Liquid collected, g	19	40	17	25.333
Volume of Water Vapor, standard cubic feet	0.89	1.88	0.80	1.190
Moisture Content of Stack Gas, %	2.03	4.16	1.84	2.677
Moisture Saturation at Stack Gas Temperature, %	5.21	5.40	5.65	5.420
Dry Mole Fraction	0.9797	0.9584	0.9816	0.973
Carbon Dioxide, %	6.5	7.4	7.7	7.200
Oxygen, %	12.5	12	11.8	12.100
Carbon Monoxide & Nitrogen, %	81	80.6	80.5	80.700
Fuel Factor	1.29	1.20	1.18	
Dry Molecular Weight, lb/lb-Mole	29.54	29.66	29.70	29.633
Wet Molecular weight, lb/lb-Mole	29.31	29.17	29.48	29.320
Flue Gas Static Pressure, inches of H2O	-0.11	-0.11	-0.11	-0.110
Absolute Flue Gas Pressure, inches of Mercury	29.43	29.43	29.43	29.430
Average Stack Gas Temperature, °F	92.42	93.58	95.08	93.693
Average Velocity Head, inches of H2O	0.084	0.082	0.085	0.084
Average Stack Gas Velocity, feet/second	16.66	16.51	16.75	16.640
Stack Cross-Sectional Area, square feet	19.635	19.635	19.635	19.635
Dry Volumetric Flow Rate, dry scfm	18,077.7	17,488.7	18,123.4	17,896.600
Actual Wet Volumetric Flue Gas Flow Rate, acfm	19,627.1	19,450.4	19,733.2	19,603.567
Percent Isokinetic of Sampling Rate, %	101.5	103.4	100.1	101.667
Percent Excess Air, %	140.7	129.3	124.8	131.600
F-Factor, dscfm/MMBtu @ %O2	0	0	0	0.000
Round Duct Diameter, inches	60	60	60	
Rectangular Duct Width, inches	0	0	0	
Rectangular Duct Length, inches	0	0	0	
Fw	0	0	0	0.000
Fc	0	0	0	0.000