Emissions To Atmosphere Report

Monitoring of Stack Emission August 2013

The Recycling Village,

Unit 21 Duleek Business Park,
Commons,
Duleek,
Co. Meath,
Ireland.

Licence Number: WFP/MH/11/0005/01
Report Date: 04th September 2013

Report Number:
3660-13-01
Version No: 0

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Report for the Periodic Monitoring of Emissions to Air

Part 1:	Executive Summary – Cover Sheet
IPPC Licence No:	WFP/MH/11/0005/01
Operator:	The Recycling Village
Installation:	Unit 21 Duleek Business Park Commons, Duleek, Co Meath
Contact Name:	Nikita Coulter
Contact No.	041 686 2366
Contract Technician:	Mark Mc Garry
Monitoring Dates:	13th August 2013
Monitoring Organisation:	AXIS environmental services
Address:	40 Coolraine Heights, Old Cratloe Road, Limerick
Date of Report:	04th September 2013
Report Approved By:	Mark Mc Garry
MCERTS Reg. No.	**MM05 573**
Function:	Environmental Manager

Signed: .....

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1 Part 1: Executive Summary

1.1 Monitoring Objectives

The Recycling Village is required to carry out air emissions monitoring for the purpose of a waste licence application. All monitoring procedures were carried out to standard methods as listed and AG2 requirements. A summary of compliance standings has been listed below:

Emission Point	Process Name	Parameters	Licence Limits	Units	Reference Conditions	Emission Summary
Main Stack	Recycling Process	Particulates	-	mg/Nm^3	STP	There are no licence limits as yet.
		Metals	-	mg/Nm^3		
		Mercury	-	mg/Nm^3		
Notes:						

1.2 Special Monitoring Requirements

None

1.3 Summary of Methods

Substance	Standard Method	AG2 Compliant	Axis Env. SOP	Limit of Detection	Calculation Spreadsheet
Flow Rates	EN 13284-1	Yes	2000	<0.8 m/s	-
Particulates	EN 13284-1	Yes	2002	<0.19 mg/m^3	5001
Metals	EN 14385	Yes	2012	<0.1 ug/m^3	5017
Mercury	EN 13211	Yes	2016	<0.1 ug/m^3	5017
Note: Limits of Detection will change between monitoring periods depending on stack conditions and volumes of air sampled.					

1.4 Monitoring Results

This table presents atmospheric emissions from analysis undertaken on behalf of The Recycling Village.

Emission Point Reference: Main Stack										
Substance to be Monitored	**Emission Limit Value**	**Periodic Monitoring Result**	**Units Reference Conditions 273 K, 101.3 kPa**	**Uncertainty Of Measurement +/-**	**Stack Flow Rate Nm^3/Hr**	**Limit Nm^3/Hr**	**Date of Sampling**	**Sampling Start/End Times**	**Method Reference**	**Operating Status**
Particulates	None	1.92	mg/Nm^3	0.39	8,335	-	13-08-2013	09:42 – 10:12	EN 13284-1	As Normal
Arsenic		<0.002	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Cadmium		<0.003	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Chromium		<0.036	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Cobalt		<0.001	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Copper		0.234	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Lead		0.184	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Manganese		0.009	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Antimony		<0.003	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Nickel		0.018	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Thallium		<0.001	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Vanadium		<0.001	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Phosphorous		<0.002	mg/Nm^3	8.35%				11:21 – 12:00	EN 14385	
Mercury		<0.001	mg/Nm^3	8.35%				11:21 – 12:00	EN 13211	
Total Metals		0.4943	mg/Nm^3							

1.6 Monitoring Deviations

Emission Point Reference	Substance Deviations	Monitoring Deviations	Other Relevant Information
Main Stack	All substances as outlined in the quote were tested.	All standard were followed – minimal sample lines were utilized	-

Report for the Periodic Monitoring of Emissions to Air

Part 2: Supporting Information

IPPC Number: None

Operator: The Recycling Village

Installation: **Duleek, Co Meath**.

Monitoring Dates: 13th August 2013

Organisation and Monitoring Team Details

AXIS environmental services,
40 Coolraine Heights,
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Mobile: 087 6367436

Date of Report: 04th September 2013

Report Approved By: Mark Mc Garry

MCERTS Reg. No: MM05.573

Function: Environmental Manager

Signed: 

Appendix I

Sampling Personnel

Team Leader	David Noonan

Equipment Checklist References

Equipment	Reference Number
TCR Tecora	AX002A
Impinger System	AX003
Sampling Nozzles	AX005
Portable Balance	AX027

Appendix II – Raw Data

POINT LIST

start ts [timestamp]	Port [###]	Point [###]	Distance [cm]	Elapsed Time [hh:mm:ss]	rw avg [0;1]	t_{fumes} avg [°C]	t_{fumes} min [°C]	t_{fumes} max [°C]	t_{probe} avg [°C]	t_{box} avg [°C]	t_{aux1} avg [°C]	t_{aux2} avg [°C]	t_{gm} avg [°C]	P_s avg [kPa]	dP pitot avg [Pa]	P_{line} avg [kPa]	P_{amb} avg [kPa]	v'_s avg [m/sec]	v'_s min [m/sec]	v'_s max [m/sec]	qV_n avg [l/min]
13/08/2013																					
09:45:29	1	1	7.7	00:05:38	0	17.431	17.328	17.509	12.556	12.813	15.234	14.562	16.553	101.549	32.023	94.571	101.554	6.019	4.496	7.883	16.865
13/08/2013																					
09:51:15	1	2	23.1	00:05:38	0	17.528	17.424	17.801	13.404	13.906	15.386	14.933	16.984	101.557	20.287	95.047	101.554	4.034	0	7.63	11.51
13/08/2013																					
10:13:44	1	3	38.5	00:05:39	0	17.513	17.463	17.568	13.868	15.105	15.82	15.492	17.403	101.572	32.734	94.363	101.554	6.093	4.511	7.562	17.265
13/08/2013																					
10:19:27	1	4	53.9	00:05:38	0	17.568	17.512	17.642	14.052	15.15	15.782	15.609	17.627	101.576	33.362	94.323	101.554	6.152	4.177	7.744	17.423
13/08/2013																					
10:25:18	2	1	7.7	00:05:39	0	17.647	17.543	17.707	14.714	15.434	15.972	15.579	17.832	101.569	51.256	91.568	101.554	7.626	5.28	9.497	21.376
13/08/2013																					
10:31:01	2	2	23.1	00:05:38	0	17.8	17.693	17.914	15.113	16.004	16.573	16.609	18.063	101.577	51.457	91.482	101.554	7.656	4.239	9.066	21.63
13/08/2013																					
10:36:48	2	3	38.5	00:05:38	0	17.928	17.815	18.029	14.713	15.926	16.213	15.806	18.302	101.587	51.676	91.495	101.554	7.668	5.738	9.834	21.544
13/08/2013																					
10:42:32	2	4	53.9	00:05:38	0	18.04	17.961	18.09	15.246	16.252	16.498	16.381	18.519	101.593	50.979	91.707	101.554	7.623	5.974	9.177	21.301

NORMALIZATION FACTOR

T_{norm}		[K]	273
P_{norm}		[kPa]	101.3

PITOT DATA SPECIFICATION

Name			p0.83
Velocity	[m/sec]	2.51	0.834
Velocity	[m/sec]	5.04	0.832
Velocity	[m/sec]	10.01	0.832
Velocity	[m/sec]	20.25	0.831
Velocity	[m/sec]	37.53	0.823

DUCT AND GAS SPECIFICATION

Name			VILLAGE	
Section			Rectangular	
Size		[m]x[m]	0.615	
Area		[m^2]	0.372	
Port	B	[#]	2	
Points	P	[#]	4	
Density	ρn	[kg/m^3]	1.286	[1.286; 1.286]
Carbon dioxide	CO_2	[%]	0	[0.000; 0.000]
Oxygen	O_2	[%]	20.9	[20.900; 20.900]
Water vapor ratio	rw	[0;1]	0	[0.000; 0.000]
Nozzle	nz	[mm]	8	
Turbolence factor	ft	[sec]	1	

DUCT FLOW RATE

Dry actual	QV_a	[m^3/h]	8851	[0; 13171]
Moist actual	$Q'V_a$	[m^3/h]	8851	[5403; 10271]
Moist standard [T_{norm}, P_{norm}]	$Q'V_n$	[m^3/h]	8335	[5090; 9665]
Dry standard [T_{norm} P_{norm}]	QV_n	[m^3/h]	8335	[5090; 9665]

AVERAGE VALUES

Total Points		[#]	8	
Velocity	v'_s	[m/sec]	6.608	[0.000; 9.834]
Stack temperature	t_s	[°C]	17.681	[17.328; 18.090]
Stack Static Pressure	$P_s$static	[kPa]	101.572	[101.532; 101.613]
Isokinetic Deviation	DI	[%]	-0.8	
Velocity at nozzle	v'_n	[m/sec]	6.553	[0.000; 8.483]
Probe temperature	t_{probe}	[°C]	14.208	[9.616; 19.983]
Box temperature	t_{box}	[°C]	15.073	[10.229; 19.842]
Aux1 temperature	t_{aux1}	[°C]	15.934	[12.483; 19.800]
Aux2 temperature	t_{aux2}	[°C]	15.621	[12.619; 19.629]
Stack Differential Pitot Pressure	dP_{pitot}	[Pa]	39.566	[0.000; 84.118]
Ambient Pressure	P_{amb}	[kPa]	101.554	[101.554; 101.554]

SAMPLED VOLUMES

Elapsed time	et	]	00:45:06	
Total encoder impulses		[#]	19261	
Standard Volume [T_{norm} P_{norm}]	V_m	[m^3]	0.828	
Volume at dgm conditions	V_{dgm}	[m^3]	0.9631	
Gas meter temperature	t_{gm}	[°C]	17.757	[16.423; 18.621]
Gas Meter Pressure	P_{dgm}	[kPa]	92.791	[89.855; 100.695]

start ts	Port	Point	Distance	Elapsed Time	rw avg	t_{tunnel} avg	t_{tunnel} min	t_{tunnel} max	t_{probe} avg	t_{box} avg	t_{aux1} avg	t_{aux2} avg	t_{pn} avg	P_s avg	dP pitot avg	P_{bar} avg	P_{amb} avg	v'_s avg	v'_s min	v'_s max	qV_a avg	DI	v'_N avg	pn avg
[timestamp]	[###]	[###]	[cm]	[hh:mm:ss]	[0;1]	[°C]	[°C]	[°C]	[°C]	[°C]	[°C]	[°C]	[°C]	[kPa]	[Pa]	[kPa]	[kPa]	[$^m/_{sec}$]	[$^m/_{sec}$]	[$^m/_{sec}$]	[$^{m^3}/_{min}$]	[%]	[$^m/_{sec}$]	[$^{kg}/_{m^3}$]
13/08/2013																								
11:21:46	1	1	7.7	00:05:38	0	18.12	18.03	18.194	15.61	16.583	17.121	16.98	18.94	101.605	34.453	94.7	101.604	6.256	4.653	8.65	17.537	-1.1	6.181	1.286
13/08/2013																								
11:27:34	1	2	23.1	00:05:38	0	18.232	18.143	18.299	16.004	16.846	16.946	17.04	18.974	101.602	33.099	94.85	101.604	6.135	4.688	7.765	17.296	-0.5	6.099	1.286
13/08/2013																								
11:33:14	1	3	38.5	00:05:38	0	18.307	18.26	18.366	16.036	16.816	16.898	17.07	19.059	101.61	32.757	94.824	101.604	6.105	4.146	7.636	17.345	0.1	6.117	1.286
13/08/2013																								
11:39:30	1	4	53.9	00:05:38	0	18.375	18.284	18.44	15.609	16.57	16.743	16.599	19.149	101.603	57.758	91.212	101.604	8.113	6.364	9.81	22.987	0	8.11	1.286
13/08/2013																								
11:45:14	2	1	7.7	00:05:38	0	18.481	18.413	18.578	15.972	16.842	17.296	17.045	19.272	101.599	54.239	91.847	101.604	7.866	5.868	9.366	22.096	-0.8	7.798	1.286
13/08/2013																								
11:50:58	2	2	23.1	00:05:38	0	18.564	18.51	18.604	16.441	17.066	17.205	16.854	19.399	101.598	55.189	91.686	101.604	7.939	6.099	9.747	22.404	-0.3	7.91	1.286
13/08/2013																								
11:56:42	2	3	38.5	00:05:38	0	18.56	18.505	18.614	16.542	17.699	17.641	17.208	19.528	101.604	53.396	92.004	101.604	7.812	5.861	9.54	21.925	-0.9	7.74	1.286
13/08/2013																								
12:02:27	2	4	53.9	00:05:38	0	18.566	18.503	18.647	16.777	17.652	17.703	17.432	19.637	101.606	53.571	91.949	101.604	7.825	6.18	9.603	22.018	-0.6	7.773	1.286

NORMALIZATION FACTOR

T_{norm}	[K]	273
P_{norm}	[kPa]	101.3

PITOT DATA SPECIFICATION

Name			p0.83
Velocity	[$^m/_{sec}$]	2.51	0.834
Velocity	[$^m/_{sec}$]	5.04	0.832
Velocity	[$^m/_{sec}$]	10.01	0.832
Velocity	[$^m/_{sec}$]	20.25	0.831
Velocity	[$^m/_{sec}$]	37.53	0.823

DUCT AND GAS SPECIFICATION

Name			RECYCLING
Section			Rectangular
Size	[m]x[m]		0.605 x
Area	[m^2]		0.372
Port	B	[#]	2
Points	P	[#]	4
Density	pn	[$^{kg}/_{m^3}$]	1.286 [1.286; 1.286]
Carbon dioxide	CO_2	[%]	0 [0.000; 0.000]
Oxygen	O_2	[%]	20.9 [20.900; 20.900]
Water vapor ratio	rw	[0;1]	0 [0.000; 0.000]
Nozzle	nz	[mm]	8
Turbolence factor	ft	[sec]	1

DUCT FLOW RATE

Dry actual	QV_a	[$^{m3}/_h$]	9718 [5553; 13139]
Moist actual	$Q'V_a$	[$^{m3}/_h$]	9719 [6177; 10867]
Moist standard [T_{norm} P_{norm}]	$Q'V_n$	[$^{m3}/_h$]	9132 [7687; 10212]
Dry standard [T_{norm} P_{norm}]	QV_n	[$^{m3}/_h$]	9132 [7687; 10212]

AVERAGE VALUES

Total Points		[#]	8
Velocity	v'_s	[$^m/_{sec}$]	7.256 [4.146; 9.810]
Stack temperature	t_s	[°C]	18.4 [18.030; 18.647]
Stack Static Pressure	$P_s$static	[kPa]	101.603 [101.579; 101.626]
Isokinetic Deviation	DI	[%]	-0.5
Velocity at nozzle	v'_N	[$^m/_{sec}$]	7.216 [0.000; 10.054]
Probe temperature	t_{probe}	[°C]	16.123 [13.293; 19.620]
Box temperature	t_{box}	[°C]	17.009 [13.128; 21.502]
Aux1 temperature	t_{aux1}	[°C]	17.194 [13.912; 21.121]
Aux2 temperature	t_{aux2}	[°C]	17.028 [14.413; 20.090]
Stack Differential Pitot Pressure	dP_{pitot}	[Pa]	46.182 [14.935; 83.612]
Ambient Pressure	P_{amb}	[kPa]	101.604 [101.604; 101.604]

SAMPLED VOLUMES

Elapsed time	et	[hh:mm:ss]	00:45:04
Total encoder impulses		[#]	21401
Standard Volume [T_{norm} P_{norm}]	V_{gn}	[m^3]	0.9144
Volume at dgm conditions	V_{dgm}	[m^3]	1.0701
Gas meter temperature	t_{gm}	[°C]	19.269 [18.899; 19.691]
Gas Meter Pressure	P_{dgm}	[kPa]	92.684 [87.594; 100.677]

SIDE STREAM

Elapsed time	etd	[hh:mm:ss]	00:00:00
Flowrate	qV_{dn}	[$^m/_{min}$]	0 [0.000; 0.000]
Volume	V_{dn}	[m^3]	0

Title:	***Determination of Total Particulates***				
Method:	EN 13284-1				
Client:	Recycling Village				
Log Sheet Complete by:	Mark McGarry		**Uncertainty Data**		
Test Date:	13/08/2013				
Laboratory Used:	RPS		**Temperature at Pump**	17.757	Deg C
Stack Name	Main Stack		**Pressure at Pump**	92.791	kPa
Test Time	09:42		**Air Volume at Pump**	0.9631	m^3
Moisture Content	0.82	%	**Humidity at Pumps**	0	%
Stack Flow Rate	8335	Nm^3/hr	**Filter Weight**	0.8	mg
Volume of Air Sampled	0.828	Nm^3	**Front End Weight**	0.8	mg
Balance Calibration	**Weight**				
300.0		g			
500.0		g			
Inpinger Weights	**Initial**	**Final**	**Difference**		
1	484.5	483.1	-1.4		
2	466.1	465.8	-0.3		
3	381	381.2	0.2		
4	633.8	640.8	7		
Volume of Air Sampled	0.828	Nm3	5.5		
Moisture Content (EN 14790)	0.82	%			
Leak Check Results	**Result**		**% Leak**		
Before Blank	100	cc/min	0.4		
After Blank	100	cc/min	0.4		
Before Sample 1	100	cc/min	0.4		
After Sample 1	100	cc/min	0.4		
Average Flow Rate	25000	cc/min	0.4		
Standard Maximum	500	cc/min	2%		
Back Pressure	-0.5	bar			
Standard Criteria to be Met	**Result**	**Standard Requirement**			
Angle of Flow	<15 Degrees	<15 Degrees			
Negative Flow in the Stack	None	None			
Pitot Pressure Difference	>5Pa	>5Pa			
Ratio of Flow Measurement	<3:1	<3:1			
Pitot Tube Leak Check	**Result**				
Positive Pressure	Pass	-			
Negative Pressure	Pass	-			
Number of Ports	2	2			
Straight length before sample point	<5	> 5 Hydraulic Diameters			
Straight length after sample point	>5	> 5 Hydraulic Diameters from fan or bend / >2 from stack exit			
Sample Calculations					
Blank (Filter and Front Wash Combined)	0	mg			
Sample 1 (Filter and Front Combined)	1.6	mg			
Volume of Air Sampled	0.8348444	Nm^3			
Blank Result	0.00	mg/Nm^3			
Sample Result	1.92	mg/Nm^3			
Emission Limit Value	50	mg/Nm^3			
Blank as Percentage of ELV	0.0	%	**Standard Requirement**	**<10% ELV**	

Appendix III Uncertainty Calculations

Uncertainty calculation for EN 13284 Determination of low range mass concentration of dust, Manual Gravimetric Method

Stack Name: Main Stack

Limit value (ELV)	50	mg.m^{-3}	Reference oxygen		% by volume
Measured concentration	1.92	mg.m^{-3} (at reference conditions)			

Measurement Equation

$$c = \frac{m}{V} f_c$$

Measured Quantities	Symbol	Value	Standard uncertainty		Units	Uncertainty as percentage	Uncertainty at Iv	Requirement of std
Sampled Volume	V_m	0.9631	uV_m	0.001	m^3	0.10		<=2%
Sampled gas T temperature	T_m	290.757	uTm	2	k	0.69		<=1%
Sampled gas Pressure	p_m	92.791	up_m	1	kPa	1.08		<=1%
Sampled gas Humidity	H_m	0	uH_m	1	% by volume	1.00		<=1%
Oxygen content	$O_{2,m}$		$uO_{2,m}$	0.1	% by volume	#DIV/0!		<=5%
Mass particulate	m	1.6	um	0.16	mg	9.90	0.38	<5% of limit value
Note - Sampled gas humidity, temperature and pressure are values at the gas meter								
Leak	L	0.40			%	0.40		<=2%
Uncollected Mass	UCM	0			mg	0		<=10%
(Instack filter - no rinse)								
Intermediate calculations								
Factor for std conds	fs	0.86						
uncertainty components	symbol	sensitivity coeff		u (in units of fs)				
	ρ_m	0.009		0.009				
	H_m	0.009		0.009				
	T_m	0.003		0.006				
	ufs			0.014		1.62		
Corrected volume	V	0.83	uV	0.013	m^3	1.63		
Factor for O2 correction	fc	1.00						
uncertainty components	symbol	sensitivity coeff		u				
	$O_{2,m}$	0.05		0.005				
Factor for O2 Correction	ufc	1.00		0.005		0.48		

$$f_s = \frac{(100 - H_m)}{100} \frac{273}{T_m} \frac{p_m}{101.3}$$

$$V = V_m f_c$$

$$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$$

Parameter		Value	Units	Sensitivity coeff	Uncertainty contribution		Uncertainty as %	
Corrected Volume (standard conditio	V	0.83	m^3	2.31	0.03	mg.m^3	1.63	%
Mass	m	1.60	mg	1.20	0.19	mg.m^3	9.90	%
Factor for O2 Correction	fc	1.00		1.92	0.01	mg.m^3	0.48	%
Leak	L	0.00	mg.m^{-3}	1.00	0.00	mg.m^3	0.23	%
Uncollected mass	UCM	0.00	mg	1.20	0.00	mg.m^3	0.00	%
Combined measurement uncertainty					**0.19**	mg.m^3		

Expanded uncertainty as percentage of measured value	**20.10**	% measured of value	**expressed with a level of confidence of 95%**
			(Using a coverage factor k=2)
Expanded uncertainty in units of measurement	**0.39**	mg.m^{-3}	
Expanded uncertainty as percentage of limit value	**0.77**	% ELV	