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ENVIRONMENTAL SERVICES

Report for the Periodic Monitoring of Emissions to Atmosphere

Veolia ES Onyx Ltd

Permit No: BW 3281IA
Installation: Redbourn Treatment Plant
Monitoring Dates: 5th June 2018
Site Address: Redbourn Road, St Albans, Hertfordshire, AL3 6RP

Report Number: 11888v1
Version: 1
Visit: 1 in 2018
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Report Author: Charlie Williams
MCERTS No: MM17 1422
MCERTS Level: 1

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MCERTS No: MM 02 089
MCERTS Level: 2 (TE1, TE2, TE3, TE4)

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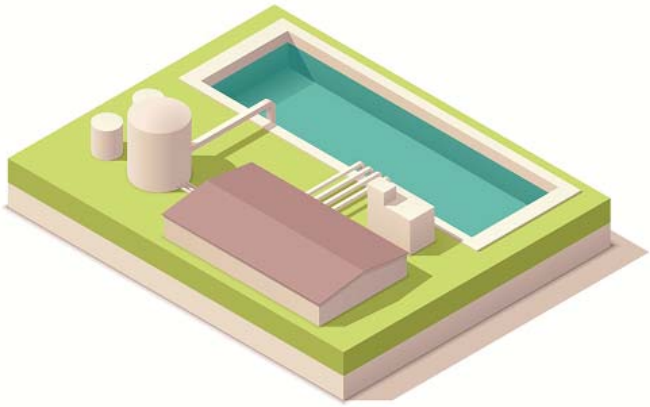

Executive Summary

Monitoring Objectives

Veolia ES (UK) Ltd operates the Redbourn Treatment Plant near St Albans, where hazardous and non-hazardous waste liquids and sludge, from a broad variety of external processes, are brought by tanker to be unloaded and treated. As part of the environmental permit BW3281IA issued to the site, Envirocare Technical Consultancy were contracted to test emissions to atmosphere from the lime silo dust filtration unit designated as emission point A2.

Testing was also conducted from the A1 Scrubber emission point, as part of an improvement program. Monitoring for potential pollutants in ambient air also took place at several key source points around the site.

The results of the testing form the basis of this report.

Emission Point Identification

Substances to be Monitored	A1	A2	F3	F4	F5
	Scrubber	Dust Silo	Sample Gantry	Waste Discharge Area	Inner Bunding
Total Particulate Matter	✓	✓	✓	✓	✓
Ammonia	✓	-	✓	✓	✓
Hydrogen Chloride	✓	-	✓	✓	✓
Hydrogen Sulphide	✓	-	✓	✓	✓
Total VOCs	✓	-	✓	✓	✓
Special requirements	None				

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation.

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (95% confidence)	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
A1 – Scrubber	Total Particulate Matter	None	**0.327**	mg/Nm^3	0.42 mg/Nm^3	273K, 101.3kPa	05/06/18	11:52 – 12:52	BS EN 13284	MCERTS	Normal
	Ammonia	None	**0.26**	mg/Nm^3	0.05 mg/Nm^3	273K, 101.3kPa	05/06/18	15:31 – 16:31	BS EN 14791	MCERTS	Normal
	Hydrogen Chloride	None	**0.022**	mg/Nm^3	0.007 mg/Nm^3	273K, 101.3kPa	05/06/18	11:52 -12:52	BS EN 1911	MCERTS	Normal
	Hydrogen Sulphide	None	**0.14**	mg/Nm^3	0.035 mg/Nm^3	273K, 101.3kPa	05/06/18	15:31 – 16:31	US EPA M11	MCERTS	Normal
	Total VOCs	None	**1.21**	mg/Nm^3	0.315 mg/Nm^3	273K, 101.3kPa	05/06/18	15:31 – 16:31	PD CEN TS 13649	MCERTS	Normal

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (95% confidence)	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
A2 – Dust Silo	Total Particulate Matter	None	**1.77**	mg/Nm^3	N/A	273K, 101.3kPa	05/06/18	15:25 – 16:25	MDHS 14/4	None	Normal

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
F3 – Sample Gantry (Fugitive)	Total Particulate Matter	None	**2.04**	mg/Nm^3	273K, 101.3kPa	05/06/18	15:20 – 16:20	MDHS 14/4	None	Normal
	Ammonia	None	**<0.01**	mg/m^3	273K, 101.3kPa	05/06/18	9:07 – 15:20	Passive Sampling	None	Normal
	Hydrogen Chloride	None	**<0.006**	mg/m^3	273K, 101.3kPa	05/06/18	9:07 – 15:20	Passive Sampling	None	Normal
	Hydrogen Sulphide	None	**<0.024**	mg/m^3	273K, 101.3kPa	05/06/18	9:07 – 15:20	Passive Sampling	None	Normal
	Total VOCs	None	**0.27**	mg/m^3	273K, 101.3kPa	05/06/18	9:07 – 15:20	Passive Sampling	None	Normal

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
F4 – Waste Discharge Area (Fugitive)	Total Particulate Matter	None	**2.33**	mg/Nm^3	273K, 101.3kPa	05/06/18	15:18 – 16:18	MDHS 14/4	None	Normal
	Ammonia	None	**0.02**	mg/m^3	273K, 101.3kPa	05/06/18	9:11 – 15:18	Passive Sampling	None	Normal
	Hydrogen Chloride	None	**0.008**	mg/m^3	273K, 101.3kPa	05/06/18	9:11 – 15:18	Passive Sampling	None	Normal
	Hydrogen Sulphide	None	**<0.024**	mg/m^3	273K, 101.3kPa	05/06/18	9:11 – 15:18	Passive Sampling	None	Normal
	Total VOCs	None	**0.45**	mg/m^3	273K, 101.3kPa	05/06/18	9:11 – 15:18	Passive Sampling	None	Normal

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
F5 – Inner Bunding (Fugitive)	Total Particulate Matter	None	**0.86**	mg/Nm^3	273K, 101.3kPa	05/06/18	15:16 – 16:16	MDHS 14/4	None	Normal
	Ammonia	None	**<0.01**	mg/m^3	273K, 101.3kPa	05/06/18	8:56 – 15:15	Passive Sampling	None	Normal
	Hydrogen Chloride	None	**0.013**	mg/m^3	273K, 101.3kPa	05/06/18	8:56 – 15:15	Passive Sampling	None	Normal
	Hydrogen Sulphide	None	**<0.024**	mg/m^3	273K, 101.3kPa	05/06/18	8:56 – 15:15	Passive Sampling	None	Normal
	Total VOCs	None	**0.22**	mg/m^3	273K, 101.3kPa	05/06/18	8:56 – 15:15	Passive Sampling	None	Normal

Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results			
								Substance	CEMS Results	Periodic Monitoring Results	Units
A1 – Scrubber	26/09/17	Continuous	Dependent on deliveries	N/A	Hazardous & non-hazardous materials.	Chemical Absorption Scrubber	Unknown	N/A	N/A	N/A	N/A
A2 – Dust Silo	26/09/17	Continuous	Intermittent	N/A	Lime	Filter	Unknown	N/A	N/A	N/A	N/A
F3 – Sample Gantry (Fugitive)	26/09/17	Batch	Varies on tanker size and number of deliveries	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F4 – Waste Discharge Area (Fugitive)	26/09/17	Batch	Varies on tanker size and number of deliveries	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F5 – Inner Bunding (Fugitive)	26/09/17	Continuous	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Monitoring Deviations

Emission Point Reference	Substance Deviations	Monitoring Deviations	Other Relevant Issues
A1 - Scrubber	None	Sampling of particulate, HCl and ammonia took place through one port however the number of points was doubled. Breakthrough of hydrogen chloride from the first impinger to the second.	None
A2 – Lime Silo	None	None	None
F3 – Sample Gantry	None	None	None
F4 – Waste Discharge Area	None	None	None
F5 – Inner Bunding	None	None	None

Supporting Information

Appendix 1: General Information

Monitoring Organisation Staff Detail

Personnel	Function in monitoring campaign	MCERTS Level	MCERTS Number
Mr C Davies	Team Leader	MCERTS Level 2 (TE1, TE2, TE3,TE4)	MM 03 252
Mr T Arden	Technician	MCERTS Trainee	MM 18 1478

Monitoring Methods

Pollutant Species	Standard	Technique	Envirocare Internal Procedure
Total Particulate Matter	BS EN 13284	Gravimetric	ETC-M-01
Total Particulate Matter	MDHS 14/4	Gravimetric	ETC-HS-01
Hydrogen Chloride	BS EN 1911	IC	ETC-M-13
Total VOCs	BS EN 13649	GC-MS	ETC-M-18
Hydrogen Sulphide	US EPA M11	Dist-VAS	ETC-M-30
Ammonia	BS EN 14791	Colorimetry	ETC-M-33
Stack Temperature + Velocity	BS EN ISO 16911-1	Pitot Tube + Thermocouple	ETC-M-46

Equipment Checklist

Equipment ID	Model Number	Purpose
P70	Sidekick	Portable sampling pump
P76	Sidekick	Portable sampling pump
ENV8	Sidekick	Portable sampling pump
ENV 6	Sidekick	Portable sampling pump
ENV 9	Sidekick	Portable sampling pump
ENV 10	Sidekick	Portable sampling pump
IP3	Westec Superprobe	Integrated Probe
CB5	Anderson Console	Isokinetic Sampler

Appendix 2: A1 Scrubber Results and Calculations

Photograph of the sampling location and positions

Flow Criteria Measurements

Duct Diameter (cm)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Stack Gas Mr (g/mol)	Pitot Coefficient
84.0	0.554	1024	16	29.00	0.835

Sample Line	Traverse Point	Traverse Position	Differential Pressure Reading (cmH2O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
LHS	1.00	4.2	0.20	0.20	0.20	0.200	4.69	15	0
	2.00	12.6	0.20	0.20	0.20	0.200	4.69	15	0
	3.00	21	0.20	0.20	0.20	0.200	4.69	15	0
	4.00	29.4	0.20	0.20	0.20	0.200	4.69	15	0
	5.00	37.8	0.20	0.20	0.20	0.200	4.69	15	0
	6.00	46.2	0.20	0.18	0.18	0.187	4.54	15	0
	7.00	54.6	0.18	0.18	0.16	0.173	4.37	15	0
	8.00	63	0.16	0.18	0.16	0.167	4.29	15	0
	9.00	71.4	0.16	0.18	0.16	0.167	4.29	15	0
	10.00	79.8	0.16	0.16	0.16	0.160	4.20	15	0

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Corrected Stack Gas Volume Flow
Value	4.51	1.1:1	15	288	9006.6	8630.2
Units	m/s	-	℃	K	m³/hr	Nm³/hr

Water Vapour Measurements

The water content was measured as a part of both the particulate and ammonia sampling processes, and was found to be between 1.41% and 1.95%.

Sampling Run No: 1

Stack details: A1	**Duct diameter:**	84.0	(cm)	**Date:**	05/06/2018
	Cross-sectional area:	0.554	(m^2)	**Operators:**	CD/TA

Meter Box No:	CB5	
Gas Meter Coefficient:	0.944	
Pitot Coefficient	0.835	
Molecular weight of Stack Gas	29.0	g/mole

Barometric Pressure (mbar)		Ambient Temperature (°C)		Leak Check (l/min)		Time	
Before	After	Before	After	Before	After	Start	End
1024	1024	16.0	18.0	0.10	0.10	11:52	12:52

Nozzle diameter=	**10.97**	**mm**
Average Stack Temperature	**14.8**	**°c**
Average Stack Velocity=	**4.65**	**metres/second**
Isokineticity =	**102.5**	**%**
Total Sampling Time=	**60.0**	**minutes**
Gasmeter Difference=	**1730.0**	**litres**
Corrected Gasmeter Volume	**1632.8**	**(Gasmeter Coefficient)**
Mean Sampling Rate =	**27.2**	**litres/minute**

Emission Calculations

Corrected Total Dry Gas Volume =	1531.27	Litres (273K; 101.3kPa)
Mass of water collected Run1=	17.6	g
Volume of Mass of Water =	21.9	NLitres
Water Content =	1.4	%
Corrected Total Particulate Matter Emission =	**0.327**	**mg/Nm³ (273K; 101.3kPa and dry gas)**
Corrected Hydrogen Chloride Emission =	**0.022**	**mg/Nm³ (273K; 101.3kPa and dry gas)**

Sampling Run No: 1

Stack details: A1	**Duct diameter:**	84.0	(cm)	**Date:**	05/06/2018
	Cross-sectional area:	0.554	(m^2)	**Operators:**	CD / TA

Meter Box No:	CB5	
Gas Meter Coefficient:	0.952	
Pitot Coefficient	0.835	
Molecular weight of Stack Gas	29.00	g/gmole
Static Pressure in Stack	0.10	cm H2O

Barometric Pressure (mbar)		Ambient Temperature (˚C)		Leak Check (l/min)		Time	
Before	After	Before	After	Before	After	Start	End
1024	1024	16.0	17.0	0.10	0.10	15:31	16:31

Average Stack Velocity=	**4.7**	**metres/second**
Total Sampling Time=	**60.0**	**minutes**
Gasmeter Difference=	**1039.0**	**litres**
Corrected Gasmeter Volume	**989.1**	**(Gasmeter Coefficient)**
Mean Sampling Rate =	**16.5**	**litres/minute**

Emission Calculations

Corrected Total Dry Gas Volume =	935.61	Litres (273K; 101.3kPa)
Ammonia Emission =	0.26	mg/Nm³ (273K; 101.3kPa; Dry)
Mass of water collected Run1=	14.8	g
Volume of Mass of Water =	18.4	NLitres
Water Content =	1.9	%
Corrected Ammonia Emission =	**0.26**	**mg/Nm³ (273K; 101.3kPa and dry gas)**

Hydrogen Sulphide

Sampling Details		
Collection Media	Zinc Acetate	-
Sampling Rate	740	mL/min
Test Duration	60.0	min
Sample Volume	44.40	L
Corrected Sample Volume	42.11	NL

Analysis Details		
1st Collector Reference	11888-Y	-
1st Collector Concentration	3.96	µg
2nd Collector Reference	11888-Z	-
2nd Collector Concentration	1.87	µg
Blank Concentration	0.05	mg/Nm³
Has breakthrough occurred?	Yes	-

Date	Operators
05/06/18	TA - CD

Parameter	Before	After	Unit
Barometric Pressure	1024	1024	mbar
Operating Temperature	18	18	℃
Leak Check	Pass	Pass	-
Time	15:31	16:31	-

Emissions Calculations		
Emission Limit Value	-	mg/Nm³
Corrected Emission	**0.14**	**mg/Nm³**
Corrected to 0% Oxygen	N/A	mg/Nm³
Mass Emission Rate	**0.00**	**kg/hr**

Sampling Details		
Collection Media	226-09	-
Sampling Rate	248	mL/min
Test Duration	60.0	min
Sample Volume	14.85	L
Corrected Sample Volume	14.08	NL

Analysis Details		
1st Collector Reference	5817315217	-
1st Collector Concentration	17	µg
2nd Collector Reference	6125811484	-
2nd Collector Concentration	<1	µg
Blank Concentration	0.07	mg/Nm³
Has breakthrough occurred?	No	-

Date	Operators
05/06/18	TA - CD

Parameter	Before	After	Unit
Barometric Pressure	1024	1024	mbar
Operating Temperature	18	18	℃
Leak Check	Pass	Pass	-
Time	15:31	16:31	-

Emissions Calculations		
Emission Limit Value	-	mg/Nm³
Corrected Emission	**1.21**	**mg/Nm³**
Corrected to 11% Oxygen	N/A	mg/Nm³
Mass Emission Rate	**0.01**	**kg/hr**

Particulates

FILTER WEIGHINGS

Filter type	110mm QMA	
Filter reference	AF	AB
	Run 1 mg	Blank mg
Filter weight change	< 0.1	< 0.1
Probe wash weight change	0.50	0.50
Total deposit	**0.50**	**0.50**

MOISTURE WEIGHINGS

	No.1 (g)	No.2(g)	No.3(g)	no.4(g)
Impinger end	589.5	604	682.2	893.8
Impinger start	602.2	594.5	678.6	876.6
Moisture in each impinger	-12.7	9.5	3.6	17.2
Total Moisture	17.6	g		

Particulate Emission Limit Value	N/A	mg/m^3	Date of Analysis	20/06/2018
Overall Blank Particulate Value	0.50	mg/m^3	Analysis Laboratory	CLS
Is overall blank less than 10% of emission limit value?	N/A		Analytical Method	Gravimetric
			Accreditation	ISO 17025

Hydrogen Chloride

HYDROGEN CHLORIDE ANALYSIS

Sample Reference	11888-B	11888-C	11888-A
	Run 1	Run 1	BLANK
	1st Impinger	2nd Impinger	
	µg	µg	µg
Hydrogen Chloride	19.8	13.5	<6
Impinger Efficiency Run 1 (%)	59	FAIL	

Ammonia

ANALYSIS RESULTS

Sample Reference		11888-K		11888-L		11888-J
		Run 1		Run 1		BLANK
		1st Impinger		2nd Impinger		
		µg		µg		µg
Ammonia		240	<	16	<	16
Impinger Efficiency Run 1 (%)		-	>	94		

MOISTURE WEIGHINGS RUN 1

		No.1 (g)	No.2(g)	No.3(g)	No.4(g)
Impinger end		555.5	766.8	604.4	901.4
Impinger start		554	762.5	602.9	893.9
Moisture in each impinger		1.5	4.3	1.5	7.5
Moisture Run 1		14.8			

Emission Limit Value	N/A	mg/m^3
Overall Blank Value	0.02	mg/m^3

Uncertainty Calculations

Particulates

TOTAL PARTICULATE MEASUREMENTS TO BS EN 13284
MEASUREMENT UNCERTAINTY CALCULATION
Run 1

Emission Limit value =	-	mg/Nm^3	Mean Emission Concentration =	0.327	mg/Nm^3
Mean Sampling Rate =	27.20	litres/minute	Monitoring Time =	60.0	mins
Leak Rate=	0.10	litres/minute	Envirocare Console used =	**CB5**	
Barometric Pressure =	1024	mbar	Temperature uncertainty =	0.24	°C
Duct Temperature =	14.8	°C	Gasmeter uncertainty =	0.37	%
Sampled Gas Volume =	1531.27	litres	Barometer used =	**BA11**	
			Barometer uncertainty =	1	mbar

Source of Uncertainty	ASD *	BS EN 13284 Uncertainty Criteria	BS EN 13284 Max Uncert Value	Envirocare Certified Value	Units	% Actual value	Source Uncert u	Combined Uncert u^2
Weighing Procedure	Std	5% of limit value		0.215	mg		0.2150	0.04623
Leak Rate	Rect	<2% of sampling rate	0.54	0.10	l/min	0.37	0.0007	0.00000
Time	Std	1sec in 1hour = 0.028%	2	1.00	secs	0.03	0.0001	0.00000
Gasmeter Volume	Std	<2%	30.63	5.67	litres	0.37	0.0012	0.00000
Std Ref Conditions Corrections								
Temperature	Std	1% of value	2.9	0.24	°C	1.62	0.0053	0.00003
Pressure	Std	1% of value	10.24	1	mbar	0.10	0.0003	0.00000
						Total		0.04626
						Combined Standard Uncertainty [(Sum u^2)^0.5]		0.215
						Measurement Uncertainty (mg/Nm^3) (95% Confidence Value)		**0.42**

Hydrogen Chloride

Hydrogen Chloride Sampling to BS EN 1911
MEASUREMENT UNCERTAINTY CALCULATION
Run 1

Emission Limit value =	N/A	mg/Nm^3	Mean Emission Concentration =	0.02	mg/Nm^3
Mean Sampling Rate =	27.20	litres/minute	Monitoring Time =	60.0	mins
Leak Rate=	0.10	litres/minute	Envirocare Console used =	**CB5**	
Barometric Pressure =	1024	mbar	Temperature uncertainty =	0.24	°C
Duct Temperature =	14.8	°C	Gasmeter uncertainty =	0.37	%
Sampled Gas Volume =	1531.27	litres	Barometer used =	**BA11**	
			Barometer uncertainty =	1	mbar

Source of Uncertainty	ASD *	BS EN 1911 Uncertainty Criteria	BS EN 1911 Max Uncert Value	Envirocare Certified Value	Units	% Actual value	Source Uncert u	Combined Uncert u^2
Leak Rate	Rect	<2% of sampling rate	0.54	0.10	l/min	0.37	0.0000	0.00000
Time	Std	1sec in 1hour = 0.028%	2	1.00	secs	0.03	0.0000	0.00000
Gasmeter Volume	Std	<2%	30.63	5.67	litres	0.37	0.0001	0.00000
Std Ref Conditions Corrections								
Temperature	Std	1% of value	2.9	0.24	°C	1.62	0.0004	0.00000
Pressure	Std	1% of value	10.24	1	mbar	0.10	0.0000	0.00000
						Total		0.000

	Analysis result mg	Analysis Uncertainty %	Analysis Uncertainty u mg	u^2	Total Sampling Uncertainty	Combined Standard Uncertainty [(Sum u^2)^0.5]	Measurement Uncertainty (95% Confidence) (mg/Nm^3)	Expanded Total Uncertainty as a percentage of ELV (95% Confidence)
HCl	0.0	10	0.00333	0.00	0.0000	0.00	**0.007**	N/A

Ammonia

Ammonia Sampling to BS EN 14791
MEASUREMENT UNCERTAINTY CALCULATION
A1 Run 1

Emission Limit value =	N/A	mg/Nm^3	Mean Emission Concentration =	0.26	mg/Nm^3
Mean Sampling Rate =	16.49	litres/minute	Monitoring Time =	60.0	mins
Leak Rate=	0.10	litres/minute	Envirocare Console used =	**CB5**	
Barometric Pressure =	1024	mbar	Temperature uncertainty =	0.24	°C
Duct Temperature =	15.0	°C	Gasmeter uncertainty =	0.37	%
Sampled Gas Volume =	935.61	litres	Barometer used =	**BA11**	
			Barometer uncertainty =	1	mbar

Source of Uncertainty	ASD *	BS EN 14791 Uncertainty Criteria	BS EN 14791 Max Uncert Value	Envirocare Certified Value	Units	% Actual value	Source Uncert u	Combined Uncert u^2
Leak Rate	Rect	<2% of sampling rate	0.33	0.10	l/min	0.61	0.0009	0.00000
Time	Std	1sec in 1hour = 0.028%	2	1.00	secs	0.03	0.0001	0.00000
Gasmeter Volume	Std	<2%	18.71	3.46	litres	0.37	0.0009	0.00000
Std Ref Conditions Corrections								
Temperature	Std	1% of value	2.9	0.24	°C	1.60	0.0041	0.00002
Pressure	Std	1% of value	10.24	1	mbar	0.10	0.0003	0.00000
							Total	0.00

	Analysis result mg	Analysis Uncertainty %	Analysis Uncertainty u mg	u^2	Total Sampling Uncertainty	Combined Standard Uncertainty [(Sum u^2)^0.5]	Measurement Uncertainty (95% Confidence) (mg/Nm^3)	Expanded Total Uncertainty as a percentage of ELV (95% Confidence)
NH3	0.26	10	0.0256	0.00	0.0000	0.03	**0.051**	N/A

Hydrogen Sulphide

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Mean Sampling Rate	0.7	L/min
Barometric Pressure	1024	mbar

Parameter	Value	Unit
Emission Concentration	0.14	mg/m³
Monitoring Duration	60	min
Average Stack Temperature	15	℃

Source of Uncertainty	Uncertainty Criteria	Actual Source Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u^2
Analysis	25% of result (95% confidence)	0.02	mg	12.50	0.017307543	0.00030
Leak Rate	<2% of sampling rate	0.01	L/min	1.35	0.002769207	0.00001
Time	1 minute	0.5	min	0.01	1.92306E-05	0.00000
Sampling Flow Rate	2% of value	0.01	L/min	1.35	0.001871086	0.00000
Std Ref Conditions						
Temperature	1% of value	0.5	℃	0.17	0.000240383	0.00000
Pressure	1% of value	5	mbar	0.49	0.000676076	0.00000
					Total	0.000
					Combined Standard Uncertainty [(sum u^2)$^{0.5}$]	0.018
					Expanded Total Uncertainty as a % of emission conc. (95% confidence)	24.973
					Expanded Total Uncertainty (mg/m³) (95% confidence)	0.035
					Expanded Total Uncertainty as a % of emission limit value (95% confidence)	-

Total Volatile Organic Compounds

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Mean Sampling Rate	0.248	L/min
Barometric Pressure	1024	mbar

Parameter	Value	Unit
Emission Concentration	1.21	mg/m³
Monitoring Duration	60	min
Average Stack Temperature	15	℃

Source of Uncertainty	Uncertainty Criteria	Actual Source Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
Analysis	25% of result (95% confidence)	0.15	mg	12.50	0.150894118	0.02277
Leak Rate	<2% of sampling rate	0.01	L/min	4.04	0.024143059	0.00058
Time	1 minute	0.5	min	0.01	0.00016766	0.00000
Sampling Flow Rate	2% of value	0.01	L/min	4.04	0.048773856	0.00238
Std Ref Conditions						
Temperature	1% of value	0.5	℃	0.17	0.002095752	0.00000
Pressure	1% of value	5	mbar	0.49	0.005894301	0.00003
					Total	0.026
					Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.161
					Expanded Total Uncertainty as a % of emission conc. (95% confidence)	26.065
					Expanded Total Uncertainty (mg/m³) (95% confidence)	0.315
					Expanded Total Uncertainty as a % of emission limit value (95% confidence)	-

Appendix 3: A2 Dust Silo Results and Calculations

Photograph of the sampling location and positions

Flow Criteria Measurements

Not applicable.

Water Vapour Measurements

Not applicable.

PARTICULATE MATTER EMISSIONS TO ATMOSPHERE DATA (MDHS 14 METHOD)

Date: 05/06/18

Site: **Veolia Redbourn**

Atmospheric Press: 1024 mbar Ambient Temperature 17 °C

PARTICULATE MONITORING (MDHS-14)																
	Duct Reference	Pump No.	Filter No.	Flow Checks Start (l/min)	Flow Checks Finish (l/min)	Average Flow (l/min)	Time ON (hr:m:s)	Time OFF (hr:m:s)	Elapsed Time (hr:m:s)	Elapsed Time (min)	Air Volume Sampled (m^3)	Filter Masses Initial (mg)	Filter Masses Final (mg)	Filter Masses Difference (mg)	Concn. Partic. Matter (mg/m^3)	Corr. Part.Matt. Concn. (mg/Nm^3)
A2	Dust Silo	Env8	**2-677**	2.05	2.07	2.06	15:25:00	16:25:00	01:00:00	60.00	0.12	-	-	0.23	1.86	**1.77**

Analysis Results

For the analysis of the passive absorption tubes see Appendix 7.

Uncertainty Calculations

Not applicable.

Appendix 4: F3 Sample Gantry (fugitive) Results and Calculations

Photograph of the sampling location and positions

Flow Criteria Measurements

Not applicable.

Water Vapour Measurements

Not applicable.

PARTICULATE MATTER EMISSIONS TO ATMOSPHERE DATA (MDHS 14 METHOD)

Date: 05/06/18

Site: **Veolia Redbourn**

Atmospheric Press: 1024 mbar Ambient Temperature 17 °C

PARTICULATE MONITORING (MDHS-14)																
Duct Reference		Pump No.	Filter No.	Flow Checks Start (l/min)	Flow Checks Finish (l/min)	Average Flow (l/min)	Time ON (hr:m:s)	Time OFF (hr:m:s)	Elapsed Time (hr:m:s)	Elapsed Time (min)	Air Volume Sampled (m^3)	Filter Masses Initial (mg)	Filter Masses Final (mg)	Filter Masses Difference (mg)	Concn. Partic. Matter (mg/m^3)	Corr. Part.Matt. Concn. (mg/Nm^3)
F3	Sample Gantry	Env6	**2-678**	2.01	2.03	2.02	15:20:00	16:20:00	01:00:00	60.00	0.12	-	-	0.26	2.15	**2.04**

Analysis Results

For the analysis of the passive absorption tubes see Appendix 7.

Uncertainty Calculations

Not Applicable.

Appendix 5: F4 Waste Discharge Area (fugitive) Results and Calculations

Photograph of the sampling location and positions

Flow Criteria Measurements

Not applicable.

Water Vapour Measurements

Not applicable.

PARTICULATE MATTER EMISSIONS TO ATMOSPHERE DATA (MDHS 14 METHOD)

Date: 05/06/18

Site: **Veolia Redbourn**

Atmospheric Press: 1024 mbar Ambient Temperature 17 °C

PARTICULATE MONITORING (MDHS-14)																
Duct Reference		Pump No.	Filter No.	Flow Checks Start (l/min)	Flow Checks Finish (l/min)	Average Flow (l/min)	Time ON (hr:m:s)	Time OFF (hr:m:s)	Elapsed Time (hr:m:s)	Elapsed Time (min)	Air Volume Sampled (m^3)	Filter Masses Initial (mg)	Filter Masses Final (mg)	Filter Masses Difference (mg)	Concn. Partic. Matter (mg/m^3)	Corr. Part.Matt. Concn. (mg/Nm^3)
F4	Waste Discharge	P70	**2-679**	2.03	2.05	2.04	15:18:00	16:18:00	01:00:00	60.00	0.12	-	-	0.30	2.45	**2.33**

Analysis Results

For the analysis of the passive absorption tubes see Appendix 7.

Uncertainty Calculations

Not applicable.

Appendix 6: F5 Inner Bunding (fugitive) Results and Calculations

Photograph of the sampling location and positions

Flow Criteria Measurements

Not applicable.

Water Vapour Measurements

Not applicable.

PARTICULATE MATTER EMISSIONS TO ATMOSPHERE DATA (MDHS 14 METHOD)

Date: 05/06/18

Site: **Veolia Redbourn**

Atmospheric Press: 1024 mbar Ambient Temperature 17 °C

PARTICULATE MONITORING (MDHS-14)																
Duct Reference		Pump No.	Filter No.	Flow Checks Start (l/min)	Flow Checks Finish (l/min)	Average Flow (l/min)	Time ON (hr:m:s)	Time OFF (hr:m:s)	Elapsed Time (hr:m:s)	Elapsed Time (min)	Air Volume Sampled (m^3)	Filter Masses Initial (mg)	Filter Masses Final (mg)	Filter Masses Difference (mg)	Concn. Partic. Matter (mg/m^3)	Corr. Part.Matt. Concn. (mg/Nm^3)
F5	Inner Bunding	P76	**2-676**	2.05	2.00	2.03	15:16:00	16:16:00	01:00:00	60.00	0.12	-	-	0.11	0.91	**0.86**

Analysis Results

For the analysis of the passive absorption tubes see Appendix 7.

Uncertainty Calculations

Not applicable.

Appendix 7: Laboratory Analysis Results

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

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Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
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Manchester
M16 9FE
Tel : 0161 874 2400
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Report Number: 743334-1

Date of Report: 20-Jun-2018

Customer: Envirocare Technical Consultancy Ltd
Office 17
Bradford Chamber Business Park
New Lane
Bradford
BD4 8BX

Customer Contact: Mr Andrew Davis

Customer Job Reference: 11888
Customer Purchase Order: 11060
Date Job Received at Concept: 11-Jun-2018
Date Analysis Started: 12-Jun-2018
Date Analysis Completed: 20-Jun-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Lauren Clarke
Customer Service Advisor

Issued by :
Lauren Clarke
Customer Service Advisor

Concept Reference: 743334
Customer Reference: 11888

Radiello 168 tube Analysed as Radiello 168 tube
Ammonia expressed as NH3

				Concept Reference	**743334 022**	**743334 023**	**743334 024**
				Customer Sample Reference	**A667B**	**A668B**	**A669B**
				Test Sample	**AR**	**AR**	**AR**
				Sampling Time (min)	**300**	**300**	**300**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Ammonia expressed as NH3	Colorimetry	1	µg	N	<1	**1**	<1
	Calc	Calc	mg/m3	N	<0.01	**0.02**	<0.01
	Calc	Calc	ppm	N	<0.020	**0.023**	<0.020

Concept Reference: 743334
Customer Reference: 11888

Filter Quartz 110mm Analysed as Filter Quartz 110mm
Miscellaneous

				Concept Reference	**743334 013**	**743334 015**
				Customer Sample Reference	**AB**	**AF**
				Test Sample	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Particulates (Total)	Grav (5 Dec)	0.10	mg	U	<0.10	<0.10
Weight Gain	Grav		mg	U	**-0.57**	**-4.6**

Concept Reference: 743334
Customer Reference: 11888

Filter IOM Analysed as Filter IOM
Miscellaneous

				Concept Reference	**743334 017**	**743334 018**	**743334 019**	**743334 020**	**743334 021**
				Customer Sample Reference	**2-680**	**2-677**	**2-678**	**2-679**	**2-676**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Particulates (Total)	Grav (5 Dec)	0.05	mg	U	**0.23**	**0.23**	**0.26**	**0.30**	**0.11**
Weight Gain	Grav		mg	U	**0.23**	**0.23**	**0.26**	**0.30**	**0.11**

Concept Reference: 743334
Customer Reference: 11888

Radiello 130 Tube Analysed as Radiello 130 Tube
TVOC

				Concept Reference	**743334 031**	**743334 032**	**743334 033**
				Customer Sample Reference	**A037P**	**A038P**	**A039P**
				Test Sample	**AR**	**AR**	**AR**
				Sampling Time (min)	**300**	**300**	**300**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Volatile Organic Compounds (Total)	GC/MS	2	µg	N	**6**	**10**	**5**
	Calc	Calc	mg/m3	N	**0.27**	**0.45**	**0.22**
	Calc	Calc	ppm	N	**0.073**	**0.12**	**0.057**

Concept Reference: 743334
Customer Reference: 11888

Wash(Acetone) Analysed as Wash(Acetone)
Particulates

				Concept Reference	**743334 014**	**743334 016**
				Customer Sample Reference	**AB**	**AF**
				Test Sample	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Particulates (Total)	Grav	0.3	mg	U	**0.5**	**0.5**

Concept Reference: 743334
Customer Reference: 11888

Radiello 170 Tube Analysed as Radiello 170 Tube
Hydrogen sulphide

				Concept Reference	**743334 028**	**743334 029**	**743334 030**
				Customer Sample Reference	**E823V**	**E824V**	**E825V**
				Test Sample	**AR**	**AR**	**AR**
				Sampling Time (min)	**300**	**300**	**300**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Hydrogen sulphide	Colorimetry	0.50	µg	N	<0.50	<0.50	<0.50
	Calc	Calc	mg/m3	N	<0.024	<0.024	<0.024
	Calc	Calc	ppm	N	<0.017	<0.017	<0.017

Concept Reference: 743334
Customer Reference: 11888

Radiello 169 tube Analysed as Radiello 169 tube
Hydrochloric acid

				Concept Reference	**743334 025**	**743334 026**	**743334 027**
				Customer Sample Reference	**A4151**	**A4161**	**A4171**
				Test Sample	**AR**	**AR**	**AR**
				Sampling Time (min)	**300**	**300**	**300**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Hydrochloric acid	IC	0.2	µg	N	(13) <0.2	(13) **0.2**	(13) **0.4**
	Calc	Calc	mg/m3	N	<0.006	**0.008**	**0.013**
	Calc	Calc	ppm	N	<0.0043	**0.0051**	**0.0087**

Concept Reference: 743334
Customer Reference: 11888

Impinger (0.05M Sulphuric Acid) Analysed as Impinger (0.1N Sulphuric Acid)
Ammonia expressed as NH3

				Concept Reference	**743334 010**	**743334 011**	**743334 012**
				Customer Sample Reference	**11888-J**	**11888-K**	**11888-L**
				Test Sample	**AR**	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Ammonia expressed as NH3	Colorimetry	0.1	mg/l	U	<0.1	**1.2**	<0.1
Volume	Vol	1	ml	U	**160**	**200**	**160**

Concept Reference: 743334
Customer Reference: 11888

Impinger(DI water) Analysed as Impinger(DI water)
Hydrogen Chloride

				Concept Reference	**743334 007**	**743334 008**	**743334 009**
				Customer Sample Reference	**11888-A**	**11888-B**	**11888-C**
				Test Sample	**AR**	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Hydrogen Chloride	IC	0.05	mg/l	U	<0.05	[13] **0.09**	[13] **0.09**
Volume	Vol	1	ml	U	**120**	**220**	**150**

Concept Reference: 743334
Customer Reference: 11888

Tube (Charcoal 226-09) Analysed as Tube (Charcoal 226-09)
TVOC

				Concept Reference	**743334 001**	**743334 002**	**743334 003**
				Customer Sample Reference	**722140340**	**5817315217**	**6125811484**
				Test Sample	**AR**	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Volatile Organic Compounds (Total)	GC/MS	1	µg	N	<1	**17**	<1

Concept Reference: 743334
Customer Reference: 11888

Impinger (zinc acetate) Analysed as Impinger (zinc acetate)
Hydrogen sulphide

				Concept Reference	**743334 004**	**743334 005**	**743334 006**
				Customer Sample Reference	**11888-X**	**11888-Y**	**11888-Z**
				Test Sample	**AR**	**AR**	**AR**
				Date Sampled	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Hydrogen sulphide	Dist-VAS	0.05	mg/l	N	**0.13**	**0.12**	**0.11**
Volume	Vol	1	ml	N	**16**	**33**	**17**

Index to symbols used in 743334-1

Value	Description
AR	As Received
13	Results have been blank corrected.
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited
C	Calculation