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Your Catalyst Contact: Stuart Davidson (07957 554 956)

Stack Emissions Testing Report Commissioned by
PCME Ltd

Installation Name & Address
Clark-Drain Ltd
Station Road
Yaxley
Peterborough
Cambridgeshire
PE7 3EG

EPR Permit: A12/92; Variation: PPC 20/09

Stack Reference
Galvanising Plant

Dates of the Monitoring Campaign
6th November 2012

Job Reference Number
CSW-0962

Report Written by
Andrew Matthews Team Leader MCERTS Level 2 MM 09 1026 TE1 TE3 TE4

Report Approved by
Paul Martin Team Leader MCERTS Level 2 MM 04 503 TE1 TE2 TE3 TE4

Report Date
15th November 2012

Version
Version 1

Signature of Report Approver


CONTENTS

Opinions and interpretations expressed herein are outside the scope of Catalyst Environmental Ltd's UKAS accreditation.

MONITORING OBJECTIVES

Clark-Drain Ltd, Yaxley
Galvanising Plant
6th November 2012

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with PCME Ltd, were commissioned to carry out stack emissions testing on the Galvanising Plant by Clark-Drain Ltd at Yaxley.

The aim of the monitoring campaign was to conduct stack emissions testing as part of PCME's calibration service in support of the PCME particulate monitor installed at the emissions point.

Special Requirements

Record the PCME Meter readings. These can be found on the back page of this Report.

Target Parameters

Total Particulate Matter

Executive Summary

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MONITORING RESULTS

Clark-Drain Ltd, Yaxley
Galvanising Plant
6th November 2012

	Concentration				Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	10.5	0.55	15	g/hr	80.9	4.2	-
Water Vapour	% v/v	2.1	0.10					
Stack Gas Temperature	°C	22.8						
Stack Gas Velocity	m/s	5.7						
Volumetric Flow Rate (ACTUAL)	m³/hr	8334						
Volumetric Flow Rate (REF) [1]	m³/hr	7715						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Executive Summary

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MONITORING DATE(S) & TIMES

Clark-Drain Ltd, Yaxley
Galvanising Plant
6th November 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	9.5	g/hr	73.0	06/11/2012	10:28 - 11:28	60
Total Particulate Matter	R2	mg/m³	8.9	g/hr	68.8	06/11/2012	11:55 - 12:55	60
Total Particulate Matter	R3	mg/m³	13.1	g/hr	100.8	06/11/2012	13:17 - 14:17	60
Velocity & Volumetric Flow Rate	R1					06/11/2012	09:15 - 09:30	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

Clark-Drain Ltd, Yaxley
Galvanising Plant
6th November 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Batch
Feedstock (if applicable)	Steel Components
Abatement System	Wet Scrubber
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	No Plume Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

Clark-Drain Ltd, Yaxley
Galvanising Plant
6th November 2012

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**UKAS Testing**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**UKAS Analysis**	**Analysis Lab**	**MCERTS Testing**	**LOD (Average)**
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.11 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All	One out of two sampling lines was used due to sampling location restrictions, however the number of sample points used on the available line were increased to meet the requirements of the Standard.

Executive Summary

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.72
Width	m	-
Area	m²	0.41
Port Depth	cm	9
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / BS EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	No
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

All platforms should be designed in accordance with the requirements in the Environment Agency's Technical Guidance Note M1 and BS EN 15259.

BS EN 15259 Homogeneity Test Requirements

There is no requirement to perform a BS EN 15259 Homogeneity Test on this Stack.

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	10.0		> 5 Pa	Yes
Mean Velocity	m/s	5.68		-	-
Lowest Gas Velocity	m/s	3.52		-	-
Highest Gas Velocity	m/s	7.04		-	-
Ratio of Above	: 1	2.00		< 3 : 1	Yes
Maximum Angle of Swirl	°	6		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

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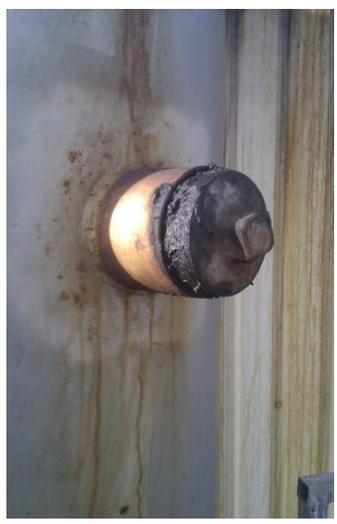
PLANT PHOTOS

Photo 1

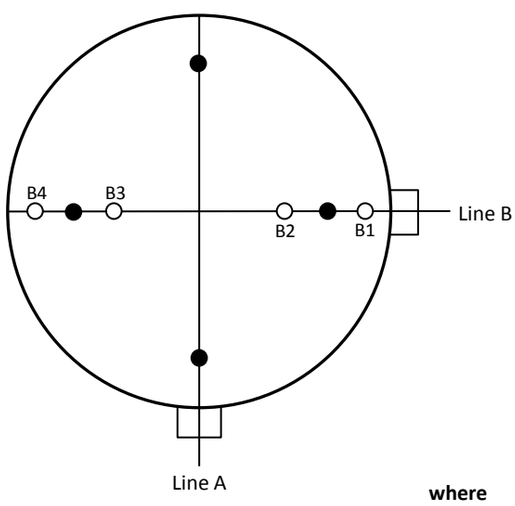
Photo 2

Photo 3

Photo 4



SAMPLE POINTS



where ○ = isokinetic point sampled at

● = isokinetic point not sampled at

APPENDIX CONTENTS

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Andrew Matthews	MCERTS Level 2	MM 09 1026	TE1 TE3 TE4
Technician	Wayne Rossouw	MCERTS Level 1	MM 10 1083	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM	CAT 7.22
Box Thermocouples	CAT 3.61
Umbilical	CAT 3.61
Oven Box	-
Probe	CAT 5.63
S-Pitot (1)	CAT 21S.33
S-Pitot (2)	CAT 21P.39
L-Pitot	-
500g Check Weight	CAT 17.17
1Kg Check Weight	CAT 17.17
Last Impinger Arm	-
Callipers	CAT 23.20
Tubes Kit Thermocouple	-
Laboratory Balance	CAT 1.18
Tape Measure	CAT 16.29

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
Testo 350 XL	-
Servomex 5200MP	-
JCT JCC P1 Cooler	-
FT-IR	-
FT-IR Sampling System	-
Bernath 3006 FID	-
Heated Head Filter	-
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	-
Mass View (2)	-
Easylogger EN-EL-12 Bit	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 3.77
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.77
Stopwatch	CAT 14.42
Barometer	CAT 13.5
Stack Thermocouple (1)	CAT 4.259
Stack Thermocouple (2)	CAT 4.306
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-
Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.72
Stack Width, W	m	-
Stack Area, A	m^2	0.41
Average Stack Gas Temperature, T_a	°C	22.8
Average Stack Gas Pressure	Pa	26.9
Average Stack Static Pressure, P_{static}	kPa	0.029
Average Barometric Pressure, P_b	kPa	101.6
Average Pitot Tube Calibration Coefficient, C_p	-	0.86

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m^3 p	Conc kg/m^3 p_i
CO_2 (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O_2 (Estimated)	-	20.8	20.4	0.2080	32.00	1.4277	0.29696
N_2	-	79.1	77.5	0.7914	28.01	1.2498	0.98913
Moisture (H_2O)	-	-	2.1	0.0210	18.02	0.8037	0.01685

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m^3	1.29
Wet Density (STP), P_{STW}	kg/m^3	1.28
Dry Density (Actual), P_{Actual}	kg/m^3	1.19
Average Wet Density (Actual), $P_{ActualW}$	kg/m^3	1.18

Where: P_{STD} = sum of component concentrations, kg/m^3 (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m^3 (including water vapour)

$P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$

$P_{ActualW}$ (at each sampling point) $= P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF [1]
Temperature	°C	22.8	0.0
Total Pressure	kPa	101.6	101.3
Moisture	%	2.10	2.10

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m^3/hr	8334
Gas Volumetric Flowrate (STP, Wet)	m^3/hr	7715
Gas Volumetric Flowrate (STP, Dry)	m^3/hr	7554
Gas Volumetric Flowrate REF [1]	m^3/hr	7715

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	06/11/2012
Time of Survey	-	09:15 - 09:30
Atmospheric Pressure	kPa	101.6
Stack Static Pressure	Pa	29
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C_p	-	0.86
Number of Lines Available	-	2
Number of Lines Used	-	1

	Swirl Point (taken at the sampling points used during testing)																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	1	2	5	6																

	Sampling Line A - Cap Stuck					Sampling Line B			
Traverse Point	Depth m	ΔP	Temp °C	Wet Density kg/m³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s
1	0.04					10.0	22.5	1.184	3.52
2	0.11					18.0	22.5	1.184	4.72
3	0.18					28.0	22.6	1.183	5.88
4	0.25					35.0	22.6	1.183	6.58
5	0.32					22.0	22.8	1.183	5.22
6	0.40					33.0	22.9	1.182	6.39
7	0.47					29.0	23.0	1.182	5.99
8	0.54					40.0	23.0	1.182	7.04
9	0.61					32.0	23.2	1.181	6.30
10	0.68					22.0	23.2	1.181	5.22
Mean						**26.9**	**22.8**	**1.182**	**5.68**

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Clark-Drain Ltd, Yaxley
Galvanising Plant

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3		Mean
Concentration	mg/m³	9.46	8.92	13.07		10.48
Uncertainty	±mg/m³	0.50	0.48	0.67		0.55
Mass Emission	g/hr	73.0	68.8	100.8		80.9
Uncertainty	±g/hr	3.9	3.7	5.2		4.2

Parameter	Units	Run 1	Run 2	Run 3		Mean
Water Vapour	% v/v	2.2	2.1	2.0		2.1
Uncertainty	±% v/v	0.11	0.10	0.10		0.10

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.11		0.11

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	BS EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	1 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B1, B2, B3, B4	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	Run 2	Run 3	
Absolute pressure of stack gas, P_s					
Barometric pressure, P_b	mmHg	762.0	762.0	762.0	
Stack static pressure, P_{static}	mmH_2O	3.0	3.0	3.0	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	762.2	762.2	762.2	
Volume of water vapour collected, V_{wstd}					
Total mass collected in impingers (liquid trap)	g	17.7	18.8	19.6	
Total mass collected in impingers (silica trap)	g	12.7	9.3	5.9	
Total mass of liquid collected, V_{lc}	g	30.4	28.1	25.5	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.0379	0.0350	0.0318	
Volume of gas metered dry, V_{mstd}					
Volume of gas sample through gas meter, V_m	m^3	1.7040	1.7110	1.5960	
Gas meter correction factor, Y_d	-	1.0210	1.0210	1.0210	
Average dry gas meter temperature, T_m	°C	14.7	15.9	18.3	
Average pressure drop across orifice, ΔH	mmH_2O	90.0	91.4	79.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	1.6698	1.6696	1.5428	
Moisture content, B_{wo} & R_{wv}					
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.0222	0.0205	0.0202	
B_{wo} as a percentage	% v/v	2.22	2.05	2.02	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	2.22	2.05	2.02	
Volume of gas metered wet, V_{mstw}					
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	1.7076	1.7046	1.5745	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$					
WID & Incinerates Hazardous Material? (Yes = no positive O_2 correction)	-	No	No	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	N/A	N/A	N/A	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	N/A	N/A	N/A	
% oxygen reference condition, $REF\%O_2$	% v/v	N/A	N/A	N/A	
O_2 Reference Factor wet $(O_{2REFw}) = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$	-	N/A	N/A	N/A	
O_2 Reference Factor dry $(O_{2REFd}) = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$	-	N/A	N/A	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m^3	N/A	N/A	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m^3	N/A	N/A	N/A	
Molecular weight of dry gas stream, M_d					
CO_2 (Estimated)	% v/v	0.06	0.06	0.06	
O_2 (Estimated)	% v/v	20.80	20.80	20.80	
Total	% v/v	20.86	20.86	20.86	
N_2	% v/v	79.14	79.14	79.14	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	28.84	28.84	28.84	
Molecular weight of stack gas (wet), M_s					
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.60	28.62	28.62	
Velocity of stack gas, V_s					
Pitot tube velocity constant, K_p	-	34.97	34.97	34.97	
Velocity pressure coefficient, C_p	-	0.83	0.83	0.83	
Average of velocity heads, ΔP_{avg}	mmH_2O	3.77	3.63	3.17	
Average square root of velocity heads, √ΔP	$\sqrt{mmH_2O}$	1.94	1.90	1.78	
Average stack gas temperature, T_s	°C	23.3	23.3	25.5	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)) / (\sqrt{(M_s)(P_s)})$	m/s	6.60	6.47	6.07	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})					
Area of stack, A_s	m^2	0.41	0.41	0.41	
$Q_a = (60)(A_s)(V_s)$	m^3/min	161.3	158.1	148.3	
Conversion factor (K/mm.Hg), C_f	-	0.3592	0.3592	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m^3/min	149.1	146.1	136.0	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	145.7	143.1	133.3	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m^3/min	N/A	N/A	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m^3/min	N/A	N/A	N/A	
Percent isokinetic, %I					
Nozzle diameter, D_n	mm	9.84	9.84	9.84	
Nozzle area, A_n	mm^2	76.06	76.06	76.06	
Total sampling time, q	min	60	60	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.2	104.1	103.3	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3	
Sampling Times	-	10:28 - 11:28	11:55 - 12:55	13:17 - 14:17	
Sampling Dates	-	06/11/2012	06/11/2012	06/11/2012	
Sampling Device	-	ISO	ISO	ISO	
Volume Sampled (REF)	m^3	1.7076	1.7046	1.5745	
Filter I.D. Number	-	47-10735	47-10743	47-10821	
Start Filter Mass	g	0.15730	0.15501	0.15609	
End Filter Mass	g	0.17302	0.16967	0.17630	
Total Mass on Filter	g	0.01572	0.01466	0.02021	
Probe Rinse I.D. Number	-	PR-47-10735	PR-47-10743	PR-47-10821	
Start Probe Rinse Mass	g	3.05465	3.12870	2.95481	
End Probe Rinse Mass	g	3.05509	3.12925	2.95518	
Total Mass in Probe Rinse	g	0.00044	0.00055	0.00037	
Total Mass Collected	mg	16.16	15.21	20.58	
Calculated Concentration	mg/m^3	9.46	8.92	13.07	
Balance Uncertainty / LOD	mg/m^3	0.11	0.11	0.11	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	06/11/2012	
Average Volume Sampled (REF)	m^3	1.6623	
Filter I.D. Number	-	47-10630	
Start Filter Mass	g	0.15517	
End Filter Mass	g	0.15521	
Total Mass on Filter	g	0.00004	
Probe Rinse I.D. Number	-	PR-47-10630	
Start Probe Rinse Mass	g	2.91384	
End Probe Rinse Mass	g	2.91389	
Total Mass in Probe Rinse	g	0.00005	
Total Mass Collected	mg	0.09	
Calculated Concentration	mg/m^3	0.05	
Balance Uncertainty / LOD	mg/m^3	0.11	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	Run 2	Run 3	
Mean Sampling Rate	l/min	29.00	29.12	27.16	
Pre-Sampling Leak Rate	l/min	0.13	0.09	0.08	
Post-Sampling Leak Rate	l/min	0.06	0.06	0.07	
Allowable Leak Rate	l/min	0.58	0.58	0.54	
Leak Test Acceptable	-	Yes	Yes	Yes	

Water Droplets	Units	Run 1	Run 2	Run 3	
Are Water Droplets Present	-	No	No	No	

MU (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Measurement Uncertainty (MU)	%	4.9	4.9	4.9	
Allowable MU	%	20	20	20	
MU Acceptable	%	Yes	Yes	Yes	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Less than 50% Faded	%	Yes	Yes	Yes	

Isokinetic Criterion Compliance	Units	Run 1	Run 2	Run 3	
Isokinetic Variation	%	102.2	104.1	103.3	
Allowable Isokinetic Range	%	95 - 115	95 - 115	95 - 115	
Isokineticity Acceptable	-	Yes	Yes	Yes	

Weighing Uncertainty Criteria	Units	Run 1	Run 2	Run 3	
Overall Weighing Uncertainty	± mg	0.31	0.31	0.31	
Overall Weighing Uncertainty	± mg/m³	0.18	0.18	0.20	
ELV [Daily ELV for WID]	mg/m³	15.00	15.00	15.00	
Allowable Weighing Uncertainty	mg/m³	0.75	0.75	0.75	
Weighing Uncertainty Acceptable	-	Yes	Yes	Yes	

Filter Temperatures	Units	Run 1	Run 2	Run 3	
Pre-Conditioning Temperature	°C	180	180	180	
Post-Conditioning Temperature	°C	160	160	160	
Maximum Filter Temperature	°C	23	23	26	

Test Conditions	Units	Run 1	Run 2	Run 3	
Ambient Temperature Recorded?	-	Yes	Yes	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.11	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m^3	1.5	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	2	3	
One out of two sampling lines was used due to sampling location restrictions, however the number of sample points used on the available line were increased to meet the requirements of the Standard.	wx	wx	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

		Value					Standard uncertainty				
Measured Quantities	**Symbol**	**Run 1**	**Run 2**	**Run 3**		**Symbol**	**Units**	**Run 1**	**Run 2**	**Run 3**	
Sampled Volume (Actual)	V_m	1.7040	1.7110	1.5960		uV_m	m^3	0.0341	0.0342	0.0319	
Sampled Gas Temperature	T_m	287.7	288.9	291.3		uT_m	K	2.0	2.0	2.0	
Sampled Gas Pressure	ρ_m	101.6	101.6	101.6		$u\rho_m$	kPa	0.5	0.5	0.5	
Sampled Gas Humidity	H_m	0.0	0.0	0.0		uH_m	% v/v	1.0	1.0	1.0	
Leak	L	0.21	0.21	0.26		uL	%	-	-	-	
Mass of Particulate	m	16.16	15.21	20.58		um	mg	0.18	0.18	0.18	
Oxygen Content	$O_{2,m}$	N/A	N/A	N/A		$uO_{2,m}$	% v/v	N/A	N/A	N/A	
Uncollected Mass	UCM	0.09	0.09	0.09		uUCM	mg	-	-	-	

	Uncertainty as a Percentage					
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**		**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	2.00	2.00		≤2%
Sampled Gas Temperature	%	0.70	0.69	0.69		≤1%
Sampled Gas Pressure	%	0.49	0.49	0.49		≤1%
Sampled Gas Humidity	%	1.00	1.00	1.00		≤1%
Leak	%	0.21	0.21	0.26		≤2%
Mass of Particulate	%	0.70	0.70	0.76		<5% of ELV
Oxygen Content	%	N/A	N/A	N/A		≤5%
Uncollected Mass	%	-	-	-		-

		Uncertainty in Measurement Units					Sensitivity Coefficient			
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 2**	**Run 3**		**Run 1**	**Run 2**	**Run 3**	
Sampled Volume (STP)	V_m	m^3	1.6698	1.6696	1.5428		5.67	5.34	8.47	
Leak	L	mg/m^3	0.011	0.011	0.019		1.00	1.00	1.00	
Mass of Particulate	L_r	mg	16.160	15.207	20.580		0.59	0.59	0.64	
Factor for O_2 Correction	$O_{2,m}$	% v/v	N/A	N/A	N/A		N/A	N/A	N/A	
Uncollected Mass	UCM	mg	0.05	0.05	0.05		0.59	0.59	0.64	

	Uncertainty in Result				
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**	
Sampled Volume (STP)	mg/m^3	0.230	0.217	0.320	
Leak	mg/m^3	0.0113	0.0106	0.0195	
Mass of Particulate	mg/m^3	0.1054	0.1056	0.1143	
Factor for O_2 Correction	mg/m^3	N/A	N/A	N/A	
Uncollected Mass	mg/m^3	0.0304	0.0305	0.0330	

Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**	
Combined uncertainty	mg/m^3	0.25	0.24	0.34	
Expanded uncertainty (95% confidence)	mg/m^3	0.50	0.48	0.67	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	0.50	0.48	0.67	
Reported Uncertainty	mg/m^3	0.50	0.48	0.67	
Expanded uncertainty (95% confidence)	%	5.3	5.4	5.1	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.3	5.4	5.1	
Reported Uncertainty	%	5.3	5.4	5.1	

PCME METER

Contract Details	
Test House Job Number	CSW-0962
Company	**Clark-Drain Ltd**
Site	Yaxley
Stack	Galvanising Plant
Sampling Date	06/11/2012
PCME Job Number	**J32913373**

Stack Conditions	Value	Units
Stack Temperature	24.1	°C
Stack Humidity	2.1	% v/v
Stack Oxygen Content	N/A	% v/v
Stack Pressure	101.6	kPa

Current Instrument Settings	Type	Serial Number
Controller Type	IM	34304
Channel Type	DT 373	34803
Channel Number	1	
Instrument Checks	Pass	
Current Calibration Factor	4.76	
Time on Display	10:24	
Time Difference - Meter v Actual	PCME meter is 40 mins fast	
GMT / BST?	GMT	
Was Time Changed?	No	

Hardware Status	
Zero	2
Span	10027
S/C	10035
Contamination Ring	Pass
Comms Check	Pass

Summary of Test Data - Results of SRM vs CEM									
Run	**Start Time**	**Finish Time**	**Instrument Average**	**Instrument Maximum**	**TPM Conc. STP WET**	**TPM Conc. STP DRY**	**TPM Conc. STP WET, % O_2**	**TPM Conc. STP DRY, % O_2**	**TPM Conc. ACTUAL**
1	10:28	11:28	4.41	36.88	9.46	9.68	N/A	N/A	8.72
2	11:55	12:55	3.25	5.10	8.92	9.11	N/A	N/A	8.22
3	13:17	14:17	3.79	7.81	13.07	13.34	N/A	N/A	12.05
Mean			**3.82**		**10.48**	**10.71**	**N/A**	**N/A**	**9.67**

For all matters relating to the function, performance and calibration of the PCME Meter, please speak directly to PCME on 01480 468 200.

Times listed in the table above relate to the actual time of the tests, and not the times as read by the PCME meter.