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Stack Emissions Testing Report Commissioned by
Henkel AG & Company

Installation Name & Address

Henkel AG & Company
5 Cromwell Road
St Neots
Cambridgeshire
PE19 1QL

Stack Reference

Extractor 1 Banbury

Dates of the Monitoring Campaign

11th December 2018

Job Reference Number

CAT-RT-4566

Report Written by
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Executive Summary

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MONITORING OBJECTIVES

Henkel AG & Company, St Neots
Extractor 1 Banbury
11th December 2018

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by Henkel AG & Company to carry out stack emissions testing on the Extractor 1 Banbury at St Neots.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter

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MONITORING RESULTS

Henkel AG & Company, St Neots

Extractor 1 Banbury

11th December 2018

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter ¹	mg/m ³	2.0	0.43	50	g/hr	12.0	2.7	-
Water Vapour	% v/v	0.70	0.04					
Stack Gas Temperature	°C	20.1						
Stack Gas Velocity	m/s	5.0	0.19					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	6443	379					
Volumetric Flow Rate (REF) ¹	m ³ /hr	6041	356					

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

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

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MONITORING DATE(S) & TIMES

Henkel AG & Company, St Neots
Extractor 1 Banbury
11th December 2018

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	2.0	g/hr	12.0	11/12/2018	11:51 - 12:21, 12:23 - 12:53	60
Velocity Traverse	R1					11/12/2018	11:30 - 11:41	

All results are expressed at the respective reference conditions.



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PROCESS DETAILS

Henkel AG & Company, St Neots
Extractor 1 Banbury
11th December 2018

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	100% of Capacity
Continuous or Batch Process	Batch
Feedstock (if applicable)	N/A
Abatement System	Bag Filter
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	None Visible

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MONITORING & ANALYTICAL METHODS

Henkel AG & Company, St Neots
Extractor 1 Banbury
11th December 2018

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.14 mg/m³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Rectangular
Depth	m	0.61
Width	m	0.59
Area	m ²	0.36
Port Depth	cm	9
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

EA Technical Guidance Note M1 / 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	Yes
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

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	6.4	> 5 Pa	Yes
Mean Velocity	m/s	4.97	-	-
Lowest Gas Velocity	m/s	2.73	-	-
Highest Gas Velocity	m/s	8.24	-	-
Ratio of Above	: 1	3.02	< 3 : 1	No
Maximum Angle of Swirl	°	6.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

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PLANT PHOTOS

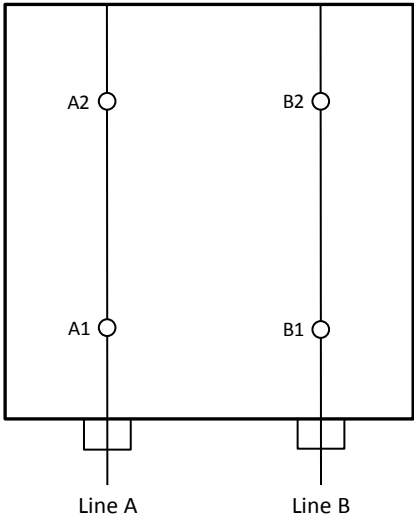
Photo 1



Photo 2



SAMPLE POINTS



where

○ = isokinetic point sampled at

● = isokinetic point not sampled at

● = combustion gases sample point

○ = non-isokinetic sample point



APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Trainee	Luke Williams	MCERTS Trainee	MM 18 1496	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.67	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.164	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.1009
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.016
Oven Box (2)	-	Gasmeter DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmeter Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	-	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	-	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	-	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.110	Mass Flow Controller (2)	-	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	-
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	-	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	-
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
Water Vapour	EN 14790	CAT-TP-05
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.61
Stack Width, W	m	0.59
Stack Area, A	m ²	0.36
Average Stack Gas Temperature, T _a	°C	18.0
Average Stack Gas Pressure	Pa	25.8
Average Stack Static Pressure, P _{static}	kPa	0.029
Average Barometric Pressure, P _b	kPa	101.2
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

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)	-	20.80	20.65	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.58	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.70	0.0070	18.02	0.8037	0.00566

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	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.284
Dry Density (Actual), P _{Actual}	kg/m ³	1.207
Average Wet Density (Actual), P _{ActualW}	kg/m ³	0.602

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	18.0	0.0
Total Pressure	kPa	101.2	101.3
Moisture	%	0.70	0.70

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	6443
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	6041
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	5999
Gas Volumetric Flowrate REF ¹	m ³ /hr	6041

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID)
(1 of 1)

Parameter	Units	Value
Date of Survey	-	11/12/2018
Time of Survey	-	11:30 - 11:41
Atmospheric Pressure	kPa	101.2
Average Stack Static Pressure	Pa	29
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	Swirl °
STATIC (Units: Pa)		21.8					35.4				
Mean		18.8	17.8	1.204	4.38		32.8	18.1	1.203	5.57	
1	0.15	31.2	17.4	1.206	6.02	5.0	58.3	17.8	1.204	8.24	6.0
2	0.46	6.4	18.2	1.203	2.73	1.0	7.2	18.4	1.202	2.90	2.0

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID) - MEASUREMENT UNCERTAINTY

(1 of 1)

Performance characteristics (Uncertainty Components)	Uncertainty	Value	Units
Standard Uncertainty on the coefficient of the Pitot Tube	$u(k)$	0.005	-
Standard Uncertainty associated with the mean local dynamic pressures	$u(\Delta p_i)$	1.074	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.069	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.000	
- Overall corrections to dynamic measurements	$u(Cf)$	0.154	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\phi O_2, w$	-	20.653	
- $\phi CO_2, w$	-	0.060	
- Oxygen, dry	$u(\phi O_2, d)$	0.637	
- Carbon Dioxide, dry	$u(\phi CO_2, d)$	0.002	
- Water Vapour	$u(\phi H_2O)$	0.036	
- Oxygen, wet	$u(\phi O_2, w)$	0.632	
- Carbon Dioxide, wet	$u(\phi CO_2, w)$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.484	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.694	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	0.759	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00649	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.167	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.096	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.187	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	3.77	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV, w)$	379.4	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV, w)/q^2V, w$	-	0.00090	
- $u^2(qV, w)$	-	37475	
- $u(qV, w)$	-	193.6	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV, w)$	5.89	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Henkel AG & Company, St Neots
Extractor 1 Banbury

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.99		1.99
Uncertainty	±mg/m ³	0.43		0.43
Mass Emission	g/hr	12.0		12.0
Uncertainty	±g/hr	2.7		2.7

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.70		0.70
Uncertainty	±% v/v	0.04		0.04

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.27		0.27

General Sampling Information

Parameter	Value	
Standard	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 Glass Fibre	
Number of Sampling Lines Used	2/2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4/4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1 & B2	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	759.0	
Stack static pressure, P_{static}	mmH ₂ O	2.2	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.2	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-3.9	
Total mass collected in impingers (silica trap)	g	10.7	
Total mass of liquid collected, V_{lc}	g	6.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0085	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.2740	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	16.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	45.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.1945	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0070	
B_{wo} as a percentage	% v/v	0.70	
Reported Water Vapour, checked with Tables in EN 14790, R_{wv}	% v/v	0.70	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.2029	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.77	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.84	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	3.88	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.97	
Average stack gas temperature, T_s	°C	20.1	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	6.72	
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	0.36	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	145.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	135.1	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	134.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	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	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.01	
Nozzle area, A_n	mm ²	50.44	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	105.9	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	11:51 - 12:21, 12:23 - 12:53
Sampling Dates	-	11/12/2018
Sampling Device	-	ISO
Volume Sampled (REF)	m ³	1.2029
Filter I.D. Number	-	47-55472
Start Filter Mass	g	0.15773
End Filter Mass	g	0.15926
Total Mass on Filter	g	0.00153
Probe Rinse I.D. Number	-	PR-47-55472
Start Probe Rinse Mass	g	3.09511
End Probe Rinse Mass	g	3.09598
Total Mass in Probe Rinse	g	0.00087
Total Mass Collected	mg	2.40
Calculated Concentration	mg/m ³	1.99
Balance Uncertainty / LOD	mg/m ³	0.14

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	11/12/2018
Average Volume Sampled (REF)	m ³	1.2029
Filter I.D. Number	-	47-55465
Start Filter Mass	g	0.15226
End Filter Mass	g	0.15245
Total Mass on Filter	g	0.00019
Probe Rinse I.D. Number	-	PR-47-55465
Start Probe Rinse Mass	g	2.98648
End Probe Rinse Mass	g	2.98661
Total Mass in Probe Rinse	g	0.00014
Total Mass Collected	mg	0.33
Calculated Concentration	mg/m ³	0.27
Balance Uncertainty / LOD	mg/m ³	0.14

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	21.1	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.42	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.1	
Allowable MU	%	20.0	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	105.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.32	
Overall Weighing Uncertainty	± mg/m ³	0.27	
ELV [Daily ELV for IED]	mg/m ³	50.00	
Allowable Weighing Uncertainty	mg/m ³	2.50	
Weighing Uncertainty Acceptable	-	Yes	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	21	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.0	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	5.0	
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	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
There are no deviations associated with the sampling employed.	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (Actual)	V _m	1.2740	uV _m	m ³	0.0255
Sampled Gas Temperature	T _m	289.8	uT _m	K	2.0
Sampled Gas Pressure	p _m	101.2	up _m	kPa	0.5
Sampled Gas Humidity	H _m	0.0	uH _m	% v/v	1.0
Leak	L	0.24	uL	%	-
Mass of Particulate	m	2.40	um	mg	0.17
Uncollected Mass	UCM	0.33	uUCM	mg	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.69	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.24	≤2%
Mass of Particulate	%	0.28	<5% of ELV
Uncollected Mass	%	-	-

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient	
	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	1.1945	1.67	
Leak	L	mg/m ³	0.003	1.00	
Mass of Particulate	L _r	mg	2.397	0.83	
Uncollected Mass	UCM	mg	0.19	0.83	

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.050
Leak	mg/m ³	0.0027
Mass of Particulate	mg/m ³	0.1413
Uncollected Mass	mg/m ³	0.1568

Measured Quantities	Oxygen Correction Part of MU Budget	
	Units	Run 1
O ₂ Correction Factor	-	N/A
Stack Gas O ₂ Content	% v/v	N/A
MU for O ₂ Correction	-	N/A
Overall MU For O ₂ Measurement	%	N/A

Parameter	Units	Run 1
Combined uncertainty	mg/m ³	0.22
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.43
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.43
Reported Uncertainty	mg/m ³	0.43
Expanded uncertainty (95% confidence), without Oxygen Correction	%	21.3
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	21.3
Reported Uncertainty	%	21.3