

Stack Emissions Monitoring Report

Job Reference: JOB-2805

Commissioned by Permali Gloucester Ltd

Operator Name

Permali Gloucester Ltd | Gloucester

Operator Address

270 Bristol Rd
Gloucester
GL1 5TT
EPR Permit 23/00006/A2

Release Point

RP 28 - Machine Shop Dust Filter

Dates of the Monitoring Campaign

12/05/2026 - 15/05/2026

Report Date | Version Number

11/06/2026 | Version 1

Cura Terra Primary Contact

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2522

Monitoring organisation name & address	Report written by	Report approved by	Report approved by signature
Cura Terra OH and Emissions Testing Limited West Yorkshire Office Bradford Chamber Business Park, New Lane Bradford, West Yorkshire, BD4 8BX	Tom Ralph Team Leader MCERTS Level 2 Endorsements: TE1 TE2 TE3 TE4 MM 22 1706 expires on 20/05/2027	Rob Hester Technical Support Manager MCERTS Level 2 Endorsements: TE1 TE2 TE3 TE4 MM 06 766 expires on 27/04/2029	

Report Contents and Monitoring Objectives

Report Contents

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Monitoring Objective

The monitoring objective was to conduct stack emissions monitoring to demonstrate compliance against a set of emission limit values (ELVs) as specified in the Site's Environmental Permit.

Special Requirements

There were no special requirements for this monitoring campaign.

Opinions and Interpretations

Any opinions or interpretations contained within this test report are outside the scope of Cura Terra's MCERTS / ISO 17025 accreditation.

Part 1: Executive Summary - Monitoring Results Summary

Monitoring Results - Summary

test parameter	EXPRESSED AS A CONCENTRATION				EXPRESSED AS A MASS EMISSION				reference conditions	accreditation status
	result	uncertainty in result +/-	limit (ELV)	units	result	uncertainty in result +/-	limit (ELV)	units		
Total Particulate Matter	87.8	2.5	20	mg/m ³	2440	2441		g/hr	STP, wet	MCERTS
Stack Gas Water Vapour	0.37	0.024		% v/v					actual	MCERTS
Stack Gas Temperature	18.0			°C					actual	MCERTS
Stack Gas Velocity	10.4	10.4		m/s					actual	MCERTS
Stack Gas Flow Rate (ACTUAL)	29535	29535		m ³ /hr					actual	MCERTS
Stack Gas Flow Rate (REF)	27800	27800		m ³ /hr					STP, wet	MCERTS

The stack gas water vapour, temperature, velocity and flow rates in the above table are calculated as an average of all of the results recorded during this monitoring campaign

The uncertainty in the result is reported at a 95% Confidence Interval in the same units as the monitoring result. In practice, this means that 95 times out of 100, the true result will lie within the stated range.

Part 1: Executive Summary - Monitoring Results Further Details

Monitoring Results - Further Details

		EXPRESSED AS A CONCENTRATION				EXPRESSED AS A MASS EMISSION				sampling date times	run time (mins)	H ₂ O (% v/v)	reference conditions
test parameter	run	result	uncertainty in result +/-	limit (ELV)	units	result	uncertainty in result +/-	limit (ELV)	units				
Total Particulate Matter	R1	87.8	2.5	20	mg/m ³	2440	2441		g/hr	12/05/2026 11:33 - 12:33	60	0.37	STP, wet
Velocity & Flow Rate Traverse	R1	10.5	10.5		m/s	29782	29782		m ³ /hr	12/05/2026 11:15 - 11:22			actual
Stack Gas Water Vapour		0.37	0.024		% v/v								actual
Stack Gas Temperature		18.0			°C								actual
Stack Gas Velocity		10.4	10.4		m/s								actual
Stack Gas Flow Rate (ACTUAL)		29535	29535		m ³ /hr								actual
Stack Gas Flow Rate (REF)		27800	27800		m ³ /hr								STP, wet

The stack gas water vapour, temperature, velocity and flow rates in the above table are calculated as an average of all of the results recorded during this monitoring campaign

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Part 1: Executive Summary - Monitoring and Analytical Methods

Monitoring and Analytical Methods

where analysis required	MONITORING					ANALYSIS					
test parameter	laboratory	accreditation number	technical procedure	reference method	monitoring status	laboratory	accreditation number	analytical procedure	analytical technique	analysis status	accreditation status
Total Particulate Matter	CTA	2522	TP-01	EN 13284-1	MCERTS	CTA	2522	AP-01	Gravimetric	MCERTS	MCERTS [Ⓛ]
Water Vapour	CTA	2522	TP-03	EN 14790	MCERTS	CTA	2522	TP-03	Gravimetric	MCERTS	MCERTS

where analysis not required	MONITORING									
test parameter	laboratory	accreditation number	technical procedure	reference method	monitoring status	measurement technique & equipment				accreditation status
Velocity & Flow Rate Traverse	CTA	2522	TP-04a	EN 16911-1 TR 17078	MCERTS	Pitot Tube, Thermocouple & Thermomanometer				MCERTS [Ⓛ]

[Ⓛ] = monitoring deviations apply to this test parameter, refer to the 'Summary of Monitoring Deviations' in the table below

Summary of Monitoring Deviations (from Appendix 2)

test parameter	run	details of monitoring deviation
Total Particulate Matter Velocity & Flow Rate Traverse	1	Due to the absence of a fixed sampling platform, and the use of a MEWP, single point sampling had to be deployed, and it was therefore not possible to sample at all the required sampling points, as per the Standard.

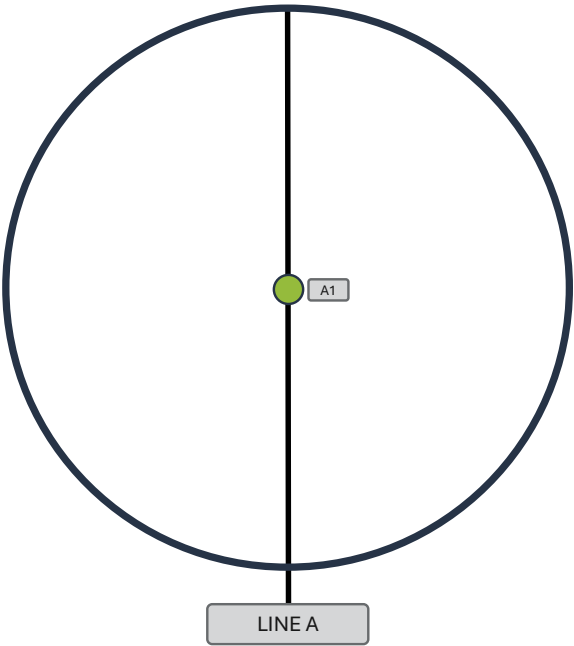
Part 1: Executive Summary - Monitoring Location

Monitoring Location Photos



Identification of Sampling Points on a Duct Diagram

refer to Appendix 2 - Raw Data to see how the points on this diagram relate to the points used for each test



Part 1: Executive Summary - Duct and Sampling Platform Information

Duct Characteristics | Sampling Ports

parameter	units	value	parameter	value	summary of all sample ports available
shape	-	Circular	primary sample port size	4" BSP	4" BSP
dimensions	-	Diameter = 1.00 m	primary sample port depth cm	9	
area	m ²	0.79	primary sample ports number of sampling lines available	1	
orientation	-	Vertical			

Sampling Location General Information

general information	details
type location access	MEWP Outside with no shelter available MEWP

CEMS | Abatement Systems

parameter	details
abatement system/s	Dust Filtration
CEMS installed on the stack	N/A

Sampling Plane Validation Criteria Summary (EN 15259) from Stack Traverse/s

criteria in EN 15259	units	value	allowed	compliant
lowest differential pressure	Pa	103.0	> 5 Pa	Yes
lowest traverse velocity	m/s	10.5	-	-
highest traverse velocity	m/s	10.5	-	-
mean traverse velocity	m/s	10.5	-	-
ratio traverse velocities	: 1	1.00	< 3 : 1	Yes
angle of swirl compliance	°	< 15	< 15°	Yes
no local negative flow	-	Yes	-	Yes

Part 1: Executive Summary - Sampling Location and Operating Information

Process Details

process detail	details
plume appearance on day of monitoring	None
type of process	Fibreglass / Resin Product Manufacture
batch or continuous process	Batch
details of any unusual process occurrences	None

Part 2: Supporting Information - Appendix 1: Monitoring Personnel, Analysis Laboratories and Test Equipment Used

Monitoring Personnel

name	position	MCERTS level number expiry	MCERTS technical endorsements
Tom Ralph	Team Leader	MCERTS Level 2 MM 22 1706 20/05/2027	TE1 TE2 TE3 TE4
Zach Holden	Technician	MCERTS Level 1 MM 23 1778 26/05/2028	TE1 TE4

Analysis Laboratories

laboratory	ISO 17025 accreditation number	laboratory short name	laboratory phone number
Cura Terra OH and Emissions Testing Limited West Yorkshire	2522	CTA	01274 738 668

Test Equipment Used

equipment type	A-EQ ID
Source sampling console	512
Low flow sampling console	657
Low flow sampling MFCs	
ThermoFID / iFID mobile	528
Horiba PG-250	
Horiba PG-350E	521
Gasmet DX4000 FTIR	
Gasmet PSS	
Protea AtmosFIR	
Protea PIB 9ump	
Gasmet syringe calibrator	
M&C PSS5-C	
Digital thermomanometer	851
Top pan balance kit	536

equipment type	A-EQ ID
S-Type pitot	650
S-Type pitot tip	655
Mini S-Type pitot	601
L-Type pitot	865
Calipers	850
Heated head filter	591
Heated tee	
1.5m heated line	
10m heated line	564
20m heated line	576
Odour barrel	
Vacuum chamber	
Dilution probe	
Tape measure	

equipment type	A-EQ ID
Barometer	735
Timer	744
10m umbilical	
30m umbilical	852
Heated probe	756 757 758
Filter oven	759
Ambient thermocouple	
Stack thermocouple	
Exit thermocouple	
Condenser thermocouple	
Tubes kit thermocouple	
2-way heater controller	656
Air sampling pump	
Analytical balance	1 492

Part 2: Supporting Information - Appendix 2: Total Particulate Matter | Run 1

Results
 reference conditions are: STP, wet

parameter	units	result ± MU (95% CI)	units	result ± MU (95% CI)
Total Particulate Matter	mg/m ³	87.8 ± 2.5	g/hr	2440 ± 2441

Analytical Laboratory Information

parameter	details
name of analytical lab	CTA
lab analytical procedure	AP-01
lab analytical technique	Gravimetric Analysis Accreditation: MCERTS
date analysis completed	26/05/2026

General Information

parameter	details
sampling date	12/05/2026
sampling times	11:33 - 12:33
sampling duration testing team	60 minutes tested by: TR ZAH
standard technical procedure	EN 13284-1 TP-01
nozzle / probe filter housing material	Titanium Titanium
filter IDs	Sample: F-9923 Blank: F-9920

parameter	details
pre-use filter conditioning temperature	250°C
filter size, material & location	47mm QF In Stack heated to 18°C
number sampling lines available	2
number sampling lines used	1
number sampling points ideal per line	4
number sampling points used per line	1
sampling point IDs	A1
volume metering device	Millennium Method 5 Source Sampling Console

Quality Assurance

QA parameter	units	sample run			blank (taken on 12/05/2026)		
		value	allowable	result	value	allowable	result
maximum allowable blank	mg/m ³	-	-	-	0.17	2.00	Pass
leak test	%	0.00	2.00	Pass	0.00	2.00	Pass
filter intact	-	Yes	-	Pass	-	-	-
filter no signs of water marks	-	Yes	-	Pass	-	-	-
maximum run filter temperature	°C	18	< 230	Pass	-	-	-
silica trap <50% faded	-	Yes	-	Pass	-	-	-
are water droplets present	-	No	-	-	-	-	-
water vapour MU	-	6.5	20.0	Pass	-	-	-
isokinetic variation	%	108.8	95 - 115	Pass	-	-	-

Breakdown of Results

reference conditions are: STP, wet

parameter	sample volume [m ³]	LOD [mg]	mass on filter [mg]	mass in rinse [mg]	mass total [mg]	LOD result [mg/m ³]	result [mg/m ³]	result reported [mg/m ³]	mass emission [g/hr]
sample run <i>F-9923</i>	1.4799	0.25	105.61	24.28	129.89	0.17	87.8	87.8	2440
blank <i>F-9920</i>	1.4799	0.25	0.27	-0.49	-0.22	0.17	-0.15	0.17	

Part 2: Supporting Information - Appendix 2: Total Particulate Matter | Run 1

Raw Data | Calculations

data	units	value
P _{bar}	mmHg	762.1
P _g	Pa	83.0
ΔH _@	mmH ₂ O	51.3
P _m	mmHg	765.8
P _s	mmHg	762.7
V _m (DGM)	m ³	1.5450
Y _d	-	1.0092
C _{stp}	-	0.3592

data	units	value
T _m	°C	18.3
ΔH _{av}	Pa	647.5
ΔP _{av}	Pa	98.7
m _{wts}	g	4.5
M _w	g/mol	18.0
V _{mol}	m ³ /mol	0.0222
T _s	°C	18.0
R _{wv} (H ₂ O)	% v/v	0.4

data	units	value
%CO _{2d}	% v/v (est)	1.00
%O _{2d}	% v/v (est)	21.00
%O _{2w}	% v/v (est)	N/A
%N _{2d}	% v/v	78.00
%O _{2ref}	% v/v	N/A
O _{2facd}	-	N/A
O _{2facw}	-	N/A
C _p (pitot)	-	0.82

data	units	value
M _d	g/mol	29.00
M _s	g/mol	28.96
R	J/mol	8.314
K ₄	-	4.64E+06
A _s	m ²	0.79
D _n	mm	7.02
A _n	mm ²	38.70
θ (sample time)	mins	60

where (est) refers to an estimated value

data	value
f _{WA}	0.995

metered volume calculations	units	value
allow favourable O ₂ correction	-	N/A
vol actual stack conditions, V _{mTa} = (V _{mTstw})(T _s + 273) / (P _s) / (C _{stp})	m ³	1.5720
vol dry, V _{mstd} = (V _m)(Y _d)(C _{stp}) / ((P _{bar} + (ΔH _{av} / 9.80665 / 13.6)) / (T _m + 273))	m ³	1.4744
vol dry, V _{mSSstd} [from side stream sampling (if applicable)]	m ³	N/A
vol dry, V _{mTstd} [total volume metered]	m ³	1.4744
vol wet, V _{mTstw} = (V _{mTstd})(100 / (100 - R _{wv}))	m ³	1.4799
vol dry O ₂ , V _{mTstdO₂} = (V _{mTstd}) / (O _{2facd})	m ³	N/A
vol wet O ₂ , V _{mTstwO₂} = (V _{mTstw}) / (O _{2facw})	m ³	N/A

isokinetic calculations	units	value
isokinetic rate, %I _f = ((K ₄)(T _s)(V _{mTstd})) / ((P _s)(v _s)(A _n)(θ)(1 - (R _{wv} / 100)))	%	108.8

stack gas density velocity volume flow rate calculations	units	value
density of stack gas, ρ = ((Ms / 1000)(Ps)(0.133322)(1000)) / ((R)(Ts + 273))	kg/m ³	1.217
velocity of stack gas, v _s = (f _{WA})(C _p)√((2(ΔP _{av}) / (ρ)))	m/s	10.4
stack gas flow actual stack conditions, Q _a = (60)(60)(A _s)(v _s)	m ³ /hr	29287.4
stack gas flow dry, Q _{std} = (Q _a)(P _s)(C _{stp})(1 - (R _{wv} / 100)) / (T _s + 273)	m ³ /hr	27469.7
stack gas flow wet, Q _{stw} = (Q _a)(P _s)(C _{stp}) / (T _s + 273)	m ³ /hr	27572.9
stack gas flow dry O ₂ , Q _{stdO₂} = (Q _a)(P _s)(C _{stp})(1 - (R _{wv} / 100)) / ((T _s + 273)(O _{2facd}))	m ³ /hr	N/A
stack gas flow wet O ₂ , Q _{stwO₂} = (Q _a)(P _s)(C _{stp}) / (T _s + 273)(O _{2facw})	m ³ /hr	N/A

Part 2: Supporting Information - Appendix 2: Total Particulate Matter | Run 1

Measurement Uncertainty (MU) Calculations

parameter	units	value	standard MU	MU as %age	required standard	value	sens coeff.	MU mg/m ³	MU factor O ₂ correction
DGM meter volume, V _m	m ³	1.5450	0.0077	0.50	≤5%	-	-	-	N/A
DGM temperature, T _m	K	291.3	2.0	0.69	≤2%	-	-	-	
DGM pressure, P _m	kPa	102.1	0.50	0.49	≤2%	-	-	-	overall MU for O ₂ correction
DGM humidity, H _m	% v/v	0	1.0	1.00	≤2%	-	-	-	N/A
DGM volume STP, V _{mstd}	m ³	-	-	-	-	1.4744	59.53	1.2	
leak, L	% ¹ mg/m ³ ²	0 ¹	-	0.00	≤2%	0 ²	1.00	0	method deviation factor
mass of particulate, m	mg	129.89	0.49	1.66	-	129.89	0.68	0.33	1.00
uncollected mass, m _{uc}	mg	0	-	0	≤10% total mass	0	1.00	0	
combined MU								1.3	
expanded MU 95% CI (k = 1.96) including method deviations MU								2.5	
expanded MU 95% CI (k = 1.96) as percentage of measured value								2.9%	
expanded MU 95% CI (k = 1.96) as percentage of measured value for mass emission								100%	result
expanded MU 95% CI (k = 1.96) as percentage of ELV [allowable 20%]								12.5%	N/A >ELV
method and sampling deviations									
Due to the absence of a fixed sampling platform, and the use of a MEWP, single point sampling had to be deployed, and it was therefore not possible to sample at all the required sampling points, as per the Standard.									

Part 2: Supporting Information - Appendix 2: Velocity & Flow Rate Traverse | Run 1

Supporting Information

parameter	units	value
barometric pressure	kPa	101.6
average wet density	kg/m ³	1.217
average stack static pressure	Pa	83.0
pitot tube coefficient, C _p	-	0.814

ND = Not Detected

NM = Not Measured

Line A					
--------	--	--	--	--	--

static pressure = 83 Pa

Pt	Depth m	ΔP Pa	Temp °C	Vel m/s	Swirl °
1	0.50	103.0	18.0	10.5	< 15

General Information

parameter	details
traverse date	12/05/2026
traverse times performed by	11:15 - 11:22 performed by: TR ZAH
standard technical procedure	EN 16911-1 TR 17078 TP-04a
device used	S-type Pitot with KIMO MP 210 (10000Pa module)

Limit of Detection (LOD) is 3.5 m/s for this device combination

Quality Assurance

parameter	details
result of pitot stagnation test	Pass
result of pitot leak check (pre)	Pass
result of pitot leak check (post)	Pass
water droplets present	No

Part 2: Supporting Information - Appendix 2: Velocity & Flow Rate Traverse | Run 1

Measurement Uncertainty (MU) Calculations

ND = Not Detected		
parameter	units	value
standard uncertainty on the coefficient of the pitot tube	-	0.0015
standard uncertainty associated with the mean local dynamic pressures	Pa	116
standard uncertainty associated with the molar mass of the gas	-	0.000026
standard uncertainty associated with the temperature	K	1.5
standard uncertainty associated with the absolute pressure in the duct	Pa	210
standard uncertainty associated with the density of the gas effluent	kg/m ³	0.0068
standard uncertainty associated with the local velocities	m/s	5.9
standard uncertainty associated with the mean velocity	m/s	5.9

ND = Not Detected		
parameter	units	value
standard uncertainty associated with the mean velocity (95% CI)	m/s	10.5
standard uncertainty associated with the mean velocity (95% CI), relative	%	100
standard uncertainty associated with the volume flow rate @ actual (95% CI)	m ³ /hr	29782
standard uncertainty associated with the volume flow rate @ actual (95% CI), relative	%	100
standard uncertainty associated with the volume flow rate @ ref 1 (95% CI)	m ³ /hr	28027
standard uncertainty associated with the volume flow rate @ ref 1 (95% CI), relative	%	100

method and sampling deviations
Due to the absence of a fixed sampling platform, and the use of a MEWP, single point sampling had to be deployed, and it was therefore not possible to sample at all the required sampling points, as per the Standard.