

Stack Emissions Monitoring Report

Job Reference: JOB-2004_2

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

Carbon Filter Inlet

Dates of the Monitoring Campaign

20/10/2025

Report Date | Version Number

16/01/2026 | Version 1

Cura Terra Primary Contact

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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 TE4 MM 22 1706 expires on 20/05/2027	Ian Baggley Stack Emissions Training Manager MCERTS Level 2 Endorsements: TE1 TE2 TE3 TE4 MM 05 653 expires on 27/11/2026	

Report Contents and Monitoring Objectives

Report Contents

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Monitoring Objective

The monitoring objective was to conduct stack emissions monitoring, as requested by the customer, for a number of prescribed pollutants.

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		
Styrene	25.2	5.7		mg/m ³	196	46.2		g/hr	STP, wet	ISO17025
Total VOCs (as Carbon)	239	16.7		mg/m ³	1860	177		g/hr	STP, wet	MCERTS
Stack Gas Temperature	14.0			°C					actual	MCERTS
Stack Gas Velocity	2.9	0.14		m/s					actual	MCERTS
Stack Gas Flow Rate (ACTUAL)	8282	538		m ³ /hr					actual	MCERTS
Stack Gas Flow Rate (REF)	7783	505		m ³ /hr					STP, wet	MCERTS

The stack 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

test parameter	run	EXPRESSED AS A CONCENTRATION				EXPRESSED AS A MASS EMISSION				sampling date times	run time (mins)	H ₂ O (% v/v)	reference conditions
		result	uncertainty in result +/-	limit (ELV)	units	result	uncertainty in result +/-	limit (ELV)	units				
Styrene	R1	25.2	5.7		mg/m ³	196	46.2		g/hr	20/10/2025 12:22 - 14:22	120		STP, wet
Total VOCs (as Carbon)	R1	239	16.7		mg/m ³	1860	177		g/hr	20/10/2025 12:22 - 14:22	120		STP, wet
Velocity & Flow Rate Traverse	R1	2.9	0.14		m/s	8282	538		m ³ /hr	20/10/2025 11:20 - 11:46			actual
Stack Gas Temperature		14.0			°C								actual
Stack Gas Velocity		2.9	0.14		m/s								actual
Stack Gas Flow Rate (ACTUAL)		8282	538		m ³ /hr								actual
Stack Gas Flow Rate (REF)		7783	505		m ³ /hr								STP, wet

The stack 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 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
Styrene	CTA	2522	ETC-SE-06a/b	PD CEN TS 13649	MCERTS	RPS	0605	O8	GC-FID	ISO17025	ISO17025

where analysis not required	MONITORING									
test parameter	laboratory	accreditation number	technical procedure	reference method	monitoring status	measurement technique & equipment				accreditation status
Total VOCs (as Carbon)	CTA	2522	ETC-SE-04	EN 12619	MCERTS	FID using iFID Mobile				MCERTS
Velocity & Flow Rate Traverse	CTA	2522	ETC-SE-24	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
Velocity & Flow Rate Traverse	1	Only one sampling line was available. The number of sampling points used on this available line was increased to meet the minimum required by the Standard.

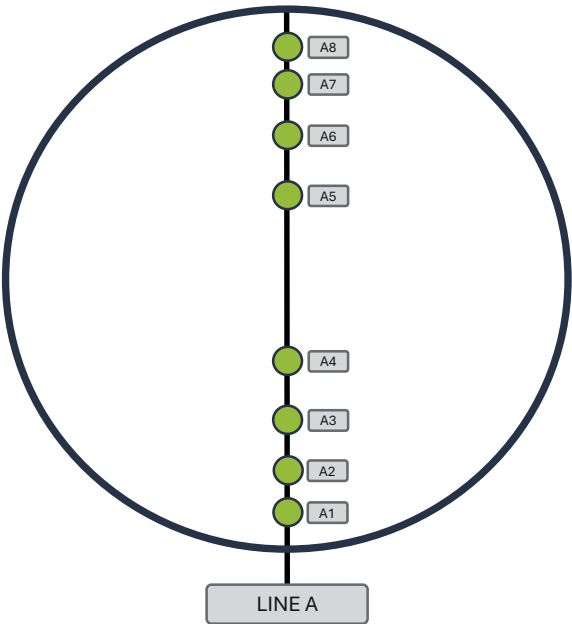
Part 1: Executive Summary - Monitoring Location

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
shape	-	Circular
dimensions	-	Diameter = 1.00 m
area	m ²	0.79
orientation	-	Vertical

parameter	value
primary sample port size	Hole
primary sample port depth cm	0
primary sample ports number of sampling lines available	1

summary of all sample ports available
Hole

Sampling Location General Information

general information	details
type location access	Floor Level Outside with no shelter available On Ground Level

CEMS | Abatement Systems

parameter	details
abatement system/s	None - Pre Abatement
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	6.7	> 5 Pa	Yes
lowest traverse velocity	m/s	2.7	-	-
highest traverse velocity	m/s	3.1	-	-
mean traverse velocity	m/s	2.9	-	-
ratio traverse velocities	: 1	1.17	< 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 visible
type of process	Fibreglass / Resin Product Manufacture
batch or continuous process	Continuous
fuel type	N/A
feedstock	Process Gas
typical load / throughput of plant	Typical
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 TE4
Zach Holden	Technician	MCERTS Level 1 MM 23 1778 26/05/2028	TE1

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
RPS Laboratories Salford	0605	RPS	0161 872 2443

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: Speciated VOCs | SPV01 | Run 1

Results reference conditions are: STP, wet

parameter	units	result ± MU (95% CI)	units	result ± MU (95% CI)
Styrene	mg/m³	25.2 ± 5.7	g/hr	196 ± 46.2

Analytical Laboratory Information

parameter	analytical lab	lab analytical procedure	lab analytical technique	date analysis completed
Styrene	RPS	O8	GC-FID Analysis Accreditation: ISO17025	24/11/2025

General Information

parameter	details
sampling date	20/10/2025
sampling times	12:22 - 14:22
sampling duration testing team	120 minutes tested by: TR ZAH
standard technical procedure	PD CEN TS 13649 ETC-SE-06a/b
probe filter housing material	Titanium Stainless Steel Heated Head
dynamic dilution employed	No
set flow rates	Pump Flow Rate: 0.5 l/min

parameter	details
filter size, material & location	Heated Head Filter Element PTFE Within Heated Head heated to 180°C
number sampling lines available	1
number sampling lines used	1
number sampling points ideal per line	1
number sampling points used per line	1
sampling point IDs	A1
capture media	Charcoal Tube
volume metering device	Air Sampling Pump

Part 2: Supporting Information - Appendix 2: Speciated VOCs | SPV01 | Run 1

Quality Assurance

parameter	units	sample run			blank (taken on 20/10/2025)		
		value	allowable	result	value	allowable	result
leak rate	%	0.00	5.00	Pass	0.00	5.00	Pass
maximum tube inlet temperature	°C	15.0	40.0	Pass	-	-	-
no condensation on tube	-	Yes	-	Pass	-	-	-
are water droplets present	-	No	-	-	-	-	-

Breakdown of Results

reference conditions are: STP, wet

blank & sample runs								
parameter	LOD [front back] [µg]	blank [front back] [µg]	sample [front back] [µg]	LOD result [mg/m³]	blank result [mg/m³]	sample result [mg/m³]	sample reported [mg/m³ with MU]	mass emission [g/hr with MU]
Styrene	2 2	< 2 < 2	1910 < 2	0.053	< 0.053	25.2	25.2 ± 5.7	196 ± 46.2

sample run volume m³	0.0758
blank volume m³	0.0758

Quality Assurance (Extended)

adsorption efficiency			
parameter	result %	allowable %	QA result
Styrene	100.0	95	Pass

measurement uncertainty (95% CI)		
result % of ELV	allowable % of ELV	QA result
N/A	25.0	N/A

allowable blank		
result mg/m³	allowable mg/m³	QA result
< 0.053	N/A	N/A

Part 2: Supporting Information - Appendix 2: Speciated VOCs | SPV01 | Run 1

Raw Data | Calculations

where (est) refers to an estimated value

data	units	value
P _{bar}	mmHg	750.8
P _g	Pa	12.0
P _s	mmHg	750.9
V _m (metered)	m ³	0.0750
C _{stp}	-	0.3592
T _s	°C	14.0
R _{wv} (H ₂ O)	% v/v	1.0
A _s	m ²	0.79

data	units	value
%CO _{2d}	% v/v (est)	0.20
%O _{2d}	% v/v (est)	21.00
%O _{2w}	% v/v (est)	N/A
%N _{2d}	% v/v	78.80
%O _{2ref}	% v/v	N/A
O _{2facd}	-	N/A
O _{2facw}	-	N/A
θ (sample time)	mins	120

metered volume calculations	units	value
allow favourable O ₂ correction	-	N/A
vol actual stack conditions, V _{ma} = (V _{mstw})(T _s + 273) / (P _s) / (C _{stp})	m ³	0.0806
vol dry, V _{mstd} = (V _m)(Y _d)(C _{stp}) / ((P _{bar} + (ΔH _{av} / 9.80665 / 13.6)) / (T _m + 273))	m ³	0.0750
vol wet, V _{mstw} = (V _{mstd}) / (100 / (100 - R _{wv}))	m ³	0.0758
vol dry O ₂ , V _{mstdO₂} = (V _{mstd}) / (O _{2facd})	m ³	N/A
vol wet O ₂ , V _{mstwO₂} = (V _{mstw}) / (O _{2facw})	m ³	N/A
velocity of stack gas, v _s = average of all velocity measurements	m/s	2.9
stack gas flow actual stack conditions, Q _a = average of all flow rate measurements	m ³ /hr	8281.7

Measurement Uncertainty (MU) Calculations (example budget presented for Styrene)

parameter	units	value	standard MU	MU as %age	required standard	value	sens coeff.	MU mg/m ³
meter volume, V _m	m ³	0.0750	0.0038	5.00	≤5%	-	-	-
volume STP, V _{mstd}	m ³	-	-	-	-	0.0750	336.51	1.3
leak, L	% ¹ mg/m ^{3 2}	0 ¹	-	0.00	≤5%	0 ²	1.00	0
laboratory result, L _r	% ¹ mg/m ^{3 2}	10.4 ¹	-	10.4	-	2.6 ²	1.00	2.6
combined MU								2.9
expanded MU 95% CI (k = 1.96) including method deviations MU								5.7
expanded MU 95% CI (k = 1.96) as percentage of measured value								22.6%
expanded MU 95% CI (k = 1.96) as percentage of measured value for mass emission								23.5%

MU factor O ₂ correction
N/A

overall MU for O ₂ correction
N/A

method deviation factor
1.00

method and sampling deviations	which SPV the deviation applies to
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Part 2: Supporting Information - Appendix 2: Total VOCs (as Carbon) | Run 1

Results reference conditions are: STP, wet

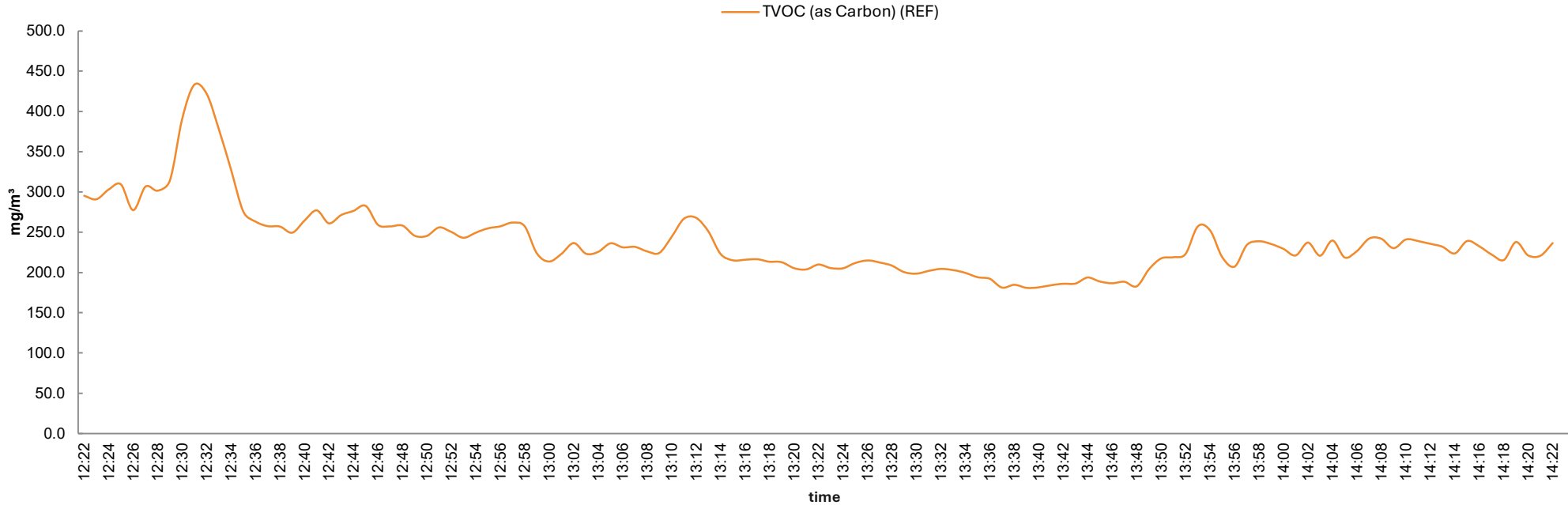
parameter	units	result ± MU (95% CI)	units	result ± MU (95% CI)
Total VOCs (as Carbon)	mg/m³	239 ± 16.7	g/hr	1860 ± 177

General Information

parameter	details
sampling start date & time	20/10/2025 12:22
sampling end date & time	20/10/2025 14:22
test time mins	120
testing team	TR ZAH
standard technical procedure	EN 12619 ETC-SE-04
analyser type	iFID Mobile
heated head & line temperature	180°C

parameter	details
probe material	Titanium
filter size, material & location	Filter Element PTFE Within Heated Head
number sampling lines available	1
number sampling lines used	1
number sampling points ideal per line	1
number sampling points used per line	1
sampling point IDs	A1

Plot of Emissions Over Time



Part 2: Supporting Information - Appendix 2: Total VOCs (as Carbon) | Run 1

Analyser Calibration Information with QA checks

where [A] = at analyser, [L] = down sampling line

CAL ID	pre-test calibration events								post-test calibration events			quality assurance					
	date & time	zero [A] [ppm]	span [A] [ppm]	zero [L] [ppm]	span [L] [ppm]	T ₉₀ [s]	leak [%]		date & time	zero [L] [ppm]	span [L] [ppm]	zero drift [%]		span drift [%]		allowable [%]	temp [°C]
1	20/10/25 11:53	-3.50	76.00	-4.10	75.80	45	0.3	P	20/10/25 14:11	-2.70	77.00	1.7	P	-0.3	P	±5	14.0

Analyser Calibration Extended Information

CAL ID	performed by	drift corr. applied	log period [s]	CYL ID	CYL conc. [ppm]	CYL expiry	CYL MU [%]	zero gas type	span [CYL] gas type	span target [ppm]	range [ppm]	LOD [ppm]
1	TR	No	60	A-CYL-164	79.68	05/06/2030	1.1	Synthetic Air	10l 80ppm Propane in Air	79.68	AUTO	0.03

Part 2: Supporting Information - Appendix 2: Total VOCs (as Carbon) | Run 1

Measurement Uncertainty (MU) Calculations

general information	units	value
emission limit value (ELV) (REF)	mg/m ³	N/A
measured concentration (REF)	mg/m ³	239

MU budget			
parameter	units	min	max
ambient temp	°C	14.0	14.0
voltage	V	90.0	130.0

overall MU for O ₂ correction
N/A

MU factor O ₂ correction
N/A

performance characteristics	MU budget input parameters				MU budget		
	symbol	units	value	source	symbol	units	value
repeatability at zero	rz	% of value	0.05	MCERTS certificate MC050062	U _{rz}	mg/m ³	0.12
repeatability at span	rs	% of value	0.08	MCERTS certificate MC050062	U _{rs}	mg/m ³	0.19
lack of fit	lof	% of value	2	maximum allowable	U _{lof}	mg/m ³	2.8
maximum short term zero drift (ABS) [after drift correction]	dz	% of value	1.7	day of testing	U _{dz}	mg/m ³	2.4
maximum short term span drift (ABS) [after drift correction]	ds	% of value	0.25	day of testing	U _{ds}	mg/m ³	0.35
influence of sample gas flow	f	% of value	-0.42	MCERTS certificate MC050062	U _f	mg/m ³	-0.58
influence of sample gas pressure	p	% of value	0	MCERTS certificate MC050062	U _p	mg/m ³	0
influence of ambient temperature zero point (/ 35k)	tz	% of value	-2.4	MCERTS certificate MC050062	U _{tz}	mg/m ³	0
influence of ambient temperature span point (/ 35k)	ts	% of value	-2.7	MCERTS certificate MC050062	U _{ts}	mg/m ³	0
influence of supply voltage (/ 60V)	v	% of value	-0.46	MCERTS certificate MC050062	U _v	mg/m ³	-0.42
cross sensitivity at zero	iz	% of value	3.8	MCERTS certificate MC050062	U _{iz}	mg/m ³	5.2
cross sensitivity at span	is	% of value	3.9	MCERTS certificate MC050062	U _{is}	mg/m ³	5.4
maximum leak	L	% of value	0.25	day of testing	U _L	mg/m ³	0.35
uncertainty associated with calibration gas	adj	% of value	1.1	span gas calibration certificate	U _{adj}	mg/m ³	1.3
combined MU						mg/m ³	8.5
expanded MU 95% CI (k = 1.96)						mg/m ³	16.7
expanded MU 95% CI (k = 1.96) as percentage of measured value						%	7
expanded MU 95% CI (k = 1.96) as percentage of measured value for mass emission						%	9.5

method and sampling deviations
Sampling was performed in full compliance with the Standard, technical procedure and regulatory requirements.

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

Supporting Information

parameter	units	value
barometric pressure	kPa	100.1
average wet density	kg/m ³	1.207
average stack static pressure	Pa	12.0
pitot tube coefficient, C _p	-	0.814

ND = Not Detected

NM = Not Measured

Line A

static pressure = 12 Pa

Pt	Depth m	ΔP Pa	Temp °C	Vel m/s	Swirl °
1	0.05	8.6	14.0	3.1	< 15
2	0.11	7.9	14.0	2.9	< 15
3	0.19	8.3	14.0	3.0	< 15
4	0.32	8.0	14.0	3.0	< 15
5	0.68	9.1	14.0	3.1	< 15
6	0.81	6.7	14.0	2.7	< 15
7	0.90	7.2	14.0	2.8	< 15
8	0.95	7.4	14.0	2.8	< 15

General Information

parameter	details
traverse date	20/10/2025
traverse times performed by	11:20 - 11:46 performed by: TR ZAH
standard technical procedure	EN 16911-1 TR 17078 ETC-SE-24
device used	S-type Pitot with KIMO MP 210 (500Pa module)

Limit of Detection (LOD) is 1 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	1
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	176
standard uncertainty associated with the density of the gas effluent	kg/m ³	0.0066
standard uncertainty associated with the local velocities	m/s	0.2
standard uncertainty associated with the mean velocity	m/s	0.07

ND = Not Detected		
parameter	units	value
standard uncertainty associated with the mean velocity (95% CI)	m/s	0.14
standard uncertainty associated with the mean velocity (95% CI), relative	%	4.7
standard uncertainty associated with the volume flow rate @ actual (95% CI)	m ³ /hr	538
standard uncertainty associated with the volume flow rate @ actual (95% CI), relative	%	6.5
standard uncertainty associated with the volume flow rate @ ref 1 (95% CI)	m ³ /hr	505
standard uncertainty associated with the volume flow rate @ ref 1 (95% CI), relative	%	6.5

method and sampling deviations
Only one sampling line was available. The number of sampling points used on this available line was increased to meet the minimum required by the Standard.