

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP-32 RTO

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 8th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-00123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



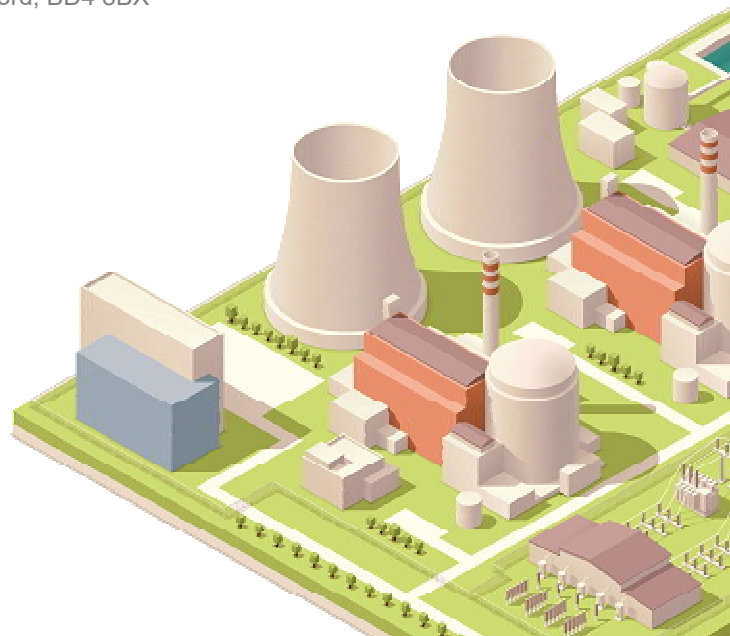
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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP-32 RTO with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP-32 RTO
Oxides of Nitrogen (as NO ₂)	✓
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

Substance		Concentration			Reference Conditions	Mass Emission			Sampling Date	Sampling Times
		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-		Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-		
Oxides of Nitrogen (as NO ₂)	R1	130	32	4.5	273k, 101.3kPa, Wet Gas	-	778	115	08/08/2024	09:05-12:24
Total VOC	R1	20	12.6	1.2	273k, 101.3kPa, Wet Gas	-	304	32	08/08/2024	09:05-12:24
Volumetric Flow (Actual)	R1	-	26,474 m³/h	1200	As Measured	-	-	-	08/08/2024	08:50-08:55
Volumetric Flow (REF)	R1	-	24,101 m³/h	1092	273k, 101.3kPa, Wet Gas	-	-	-	08/08/2024	08:50-08:55

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	RTO
Continuous or Batch Process	Continuous
Operating Status	Maximum Capacity
Feedstock	Extraction
Normal Load, Throughput or Continuous Rating	Maximum Capacity
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	Natural Gas
Plume Appearance	None Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Oxides of Nitrogen	BS EN 14792	ETC-SE-10 (a/b)	Yes	Chemiluminescence by Horiba PG-250 or Horiba PG-350			
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			

Envirocare: 2522

Equipment Checklist

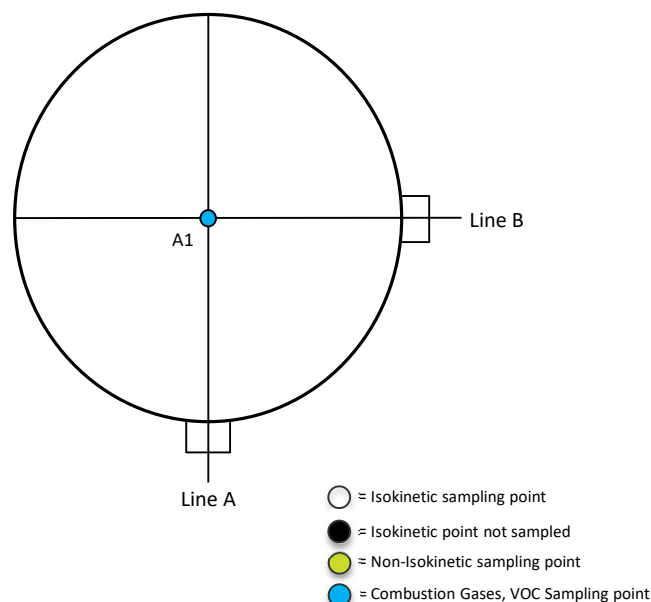
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	ETC-S-12:13	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	Testo iFID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP-32 RTO Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	1.00
Width	m	-
Area	m ²	0.8
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2

Platform Type and Location	
Platform Type - Permanent / Temporary	Permanent
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
1.00	0.8	1010	21.0	21.0	11.0	1.0	30.5	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	14.6	75.6	76.8	74.3	75.6	9.3	26	2
	A2	85.4	77.5	76.4	76.8	76.9	9.4	26	2

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	14.6	79.6	77.8	78.9	78.8	9.5	26	2
	B2	85.4	78.6	78.3	79.5	78.8	9.5	27	3

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	9.4	1.0:1	26	299	26474	24101	24101
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Instrumental Gas Analyser Calibrations

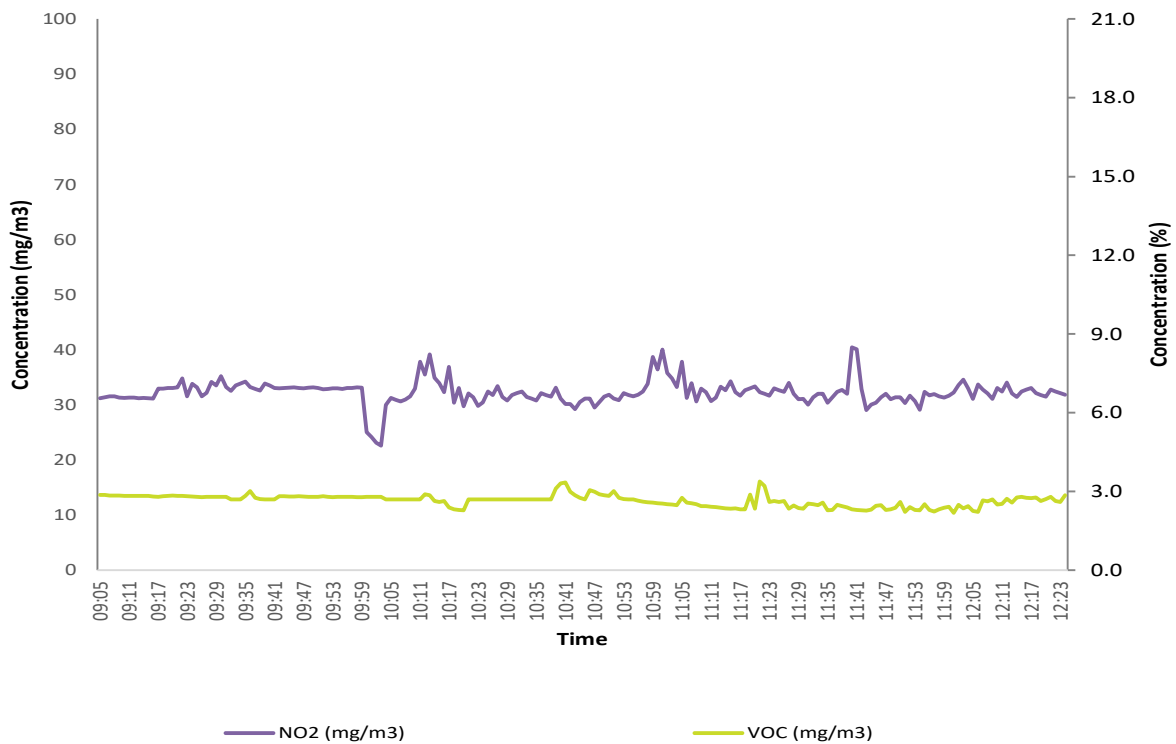
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
08/08/2024	LH	12.08	lfid

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Nitrogen Monoxide	199.8ppm	250ppm	75	200	0.00	200	0.00	198	0.00	-0.95	Yes
Propane	81.54ppm	100ppm	35	82.0	0.00	81.3	0.00	80.9	0.00	-1.35	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Oxides of Nitrogen (as NO ₂)	1	32	40	22.6	mg/m ³	NO _x as NO ₂	-
Total VOC	1	12.62	16.11	10.43	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Oxides of Nitrogen by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	130	mg/m ³
Reading	15.7	ppm
Span Gas Certified Value	200	ppm
Range	250	ppm

Cal Gas
NO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.00	0.00
Span Drift (ppm)	1.9	Rectangular	1.73	1.10	1.2
Linearity (% of value)	0.54	Rectangular	1.73	0.05	0.002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.06	0.003
Interference (% of value)	0.63	Rectangular	1.73	0.06	0.003
Standard deviation of repeatability at zero point (% of range)	0.00	Rectangular	-	0.000	0.000
Standard deviation of repeatability at span point (% of range)	0.10	Rectangular	-	0.25	0.06
Total					1.3
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					1.1
Expanded Total Uncertainty (ppm) (95% confidence)					2.2
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					14.1
Expanded Total Uncertainty (mg/m³) (95% confidence)					4.5
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					3.5

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit
Emission Limit Value (ELV)	20	mg/m ³
Reading	7.85	ppm
Span Gas Certified Value	81.5	ppm
Range	100	ppm

Cal Gas
C ₃ H ₈

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	0.40	Rectangular	1.73	0.23	0.05
Linearity (% of value)	0.82	Rectangular	1.73	0.0372	0.001
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.0275	0.0008
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.045	0.002
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.14
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.38
Expanded Total Uncertainty (ppm) (95% confidence)					0.74
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					9.4
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.2
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					5.9

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	26474	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.02	-
Standard Uncertainty - Mean Velocity	0.11	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.21	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	2.2	%
Standard Uncertainty - Volumetric Flow Rate	612	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	1200	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP29 - Dust Filtration (DP5)

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 6th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-00123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



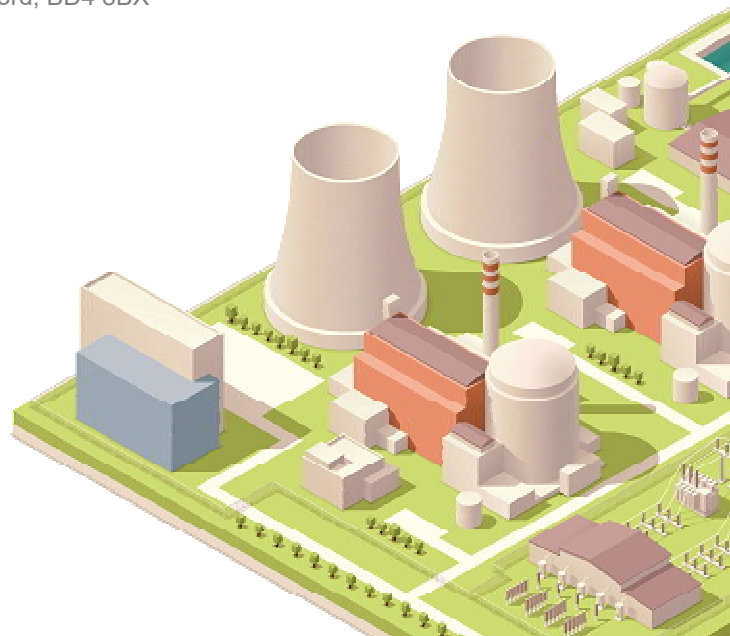
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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP29 - Dust Filtration (DP5) with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP29 - Dust Filtration (DP5)
Total Particulate Matter	✓
Water Vapour	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	20	6.1	0.57	273k, 101.3kPa, Wet Gas	-	222	23.0	06/08/2024	13:38-14:10
Water Vapour	R1	-	1.0%	-	As Measured	-	-	-	-	-
Volumetric Flow (Actual)	R1	-	39,930 m³/h	1810	As Measured	-	-	-	06/08/2024	13:00 - 13:25
Volumetric Flow (REF)	R1	-	36,447 m³/h	1652	273k, 101.3kPa, Wet Gas	-	-	-	06/08/2024	13:00 - 13:25

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Dust Filtration
Continuous or Batch Process	Continuous Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

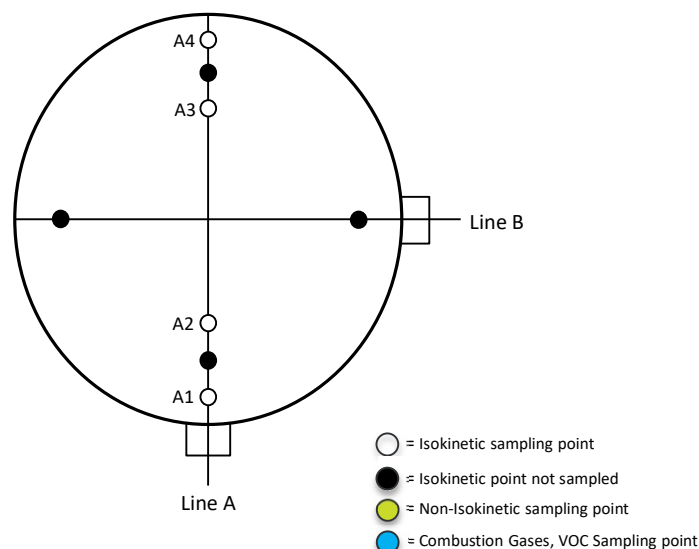
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	SK-Thermo FID	-	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP29 - Dust Filtration (DP5) Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	1.00
Width	m	-
Area	m ²	0.8
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A

Platform Type and Location	
Platform Type - Permanent / Temporary	Permanent
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
1.00	0.8	1000	20.0	21.0	10.0	1.0	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	6.7	178.6	168.4	179.6	175.5	14.2	22	6
	A2	25.0	179.2	172.5	164.3	172.0	14.1	23	6
	A3	75.0	173.2	174.8	171.6	173.2	14.1	22	7
	A4	93.3	175.6	167.8	170.2	171.2	14.0	22	8

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	14.1	1.0:1	22	295	39930	36447	36447
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.086	-
Pitot Coefficient	.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	2.9	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	5.0	mm
Average Gas Meter Temperature	23.1	°C
Average Stack Temperature	22	°C
Average Stack Velocity	14.8	m/s
Isokineticity	103.8	%
Total Sampling Time	32	min
Gas Meter Difference	532	L
Corrected Gas Meter Volume	578	L
Mean Sampling Rate	18.0	L/min

Date	Operators
06/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1009	1009	mbar
Ambient Temperature	22.0	23.0	°C
Leak Check	0.00	-	L/min
Time	13:38	14:10	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.530	Nm ³
Gas Meter Volume (REF)	0.536	Nm ³
Stack Gas Water Vapour Content	1.0	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	6.1	mg/Nm ³
TPM Mass Emissions (REF)	222	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-7169	47mm GFA	0.24	< 0.25	0.49
1	PR-47-7168	47mm GFA	2.55	0.72	3.27

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1452.3	1266.4	1210.1	1431.1	4.3
	After	1453.9	1267.2	1210.6	1432.5	

Parameter	Value	Unit
Emission Limit Value (ELV)	20	mg/m ³
Overall Blank Value (OBV)	0.91	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	19/08/2024
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	20	mg/m ³
Mean Sampling Rate	18.0	L/min
Leak Rate	0.00	L/min
Barometric Pressure	1009	mbar
Average Stack Temperature	22	°C
Sampled Stack Gas Volume	532	L

Parameter	Value	Unit
Mean Emission Concentration	6.1	mg/m ³
Monitoring Duration	32	min
Console ID	8.13	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	1	0.28	mg	1.4	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.36	0.000	L/min	0.000	0.000	0.00000
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.002	0.000003
Gasmeter Volume	Std	<2%	10.6	2.0	L	0.37	0.02	0.0005
Temperature	Std	1% of value	0.22	0.24	°C	1.1	0.07	0.004
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.006	0.00004
Total								0.08
Combined Standard Uncertainty [(sum u²)^{0.5}]								0.29
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								9.3
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.57
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								2.8

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	39930	m ³ /hr

Performance Characteristics & Source Value		Value	Units
Standard Uncertainty - Pitot tube Coefficient		0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure		1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas		0.0001	-
Standard Uncertainty - Stack Gas Temperature		0.50	K
Standard Uncertainty - Absolute Pressure in Duct		176	Pa
Standard Uncertainty - Density of Stack Gas		0.03	-
Standard Uncertainty - Mean Velocity		0.18	m/s
Expanded Uncertainty Mean Velocity (95% confidence)		0.35	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative		2.5	%
Standard Uncertainty - Volumetric Flow Rate		924	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)		1810	m ³ /hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative		4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP 31 - Carbon Filter

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 6th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-0123	Version:	1	Visit:	2 in 2024
Date of Report:	6th August 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)

Signed:



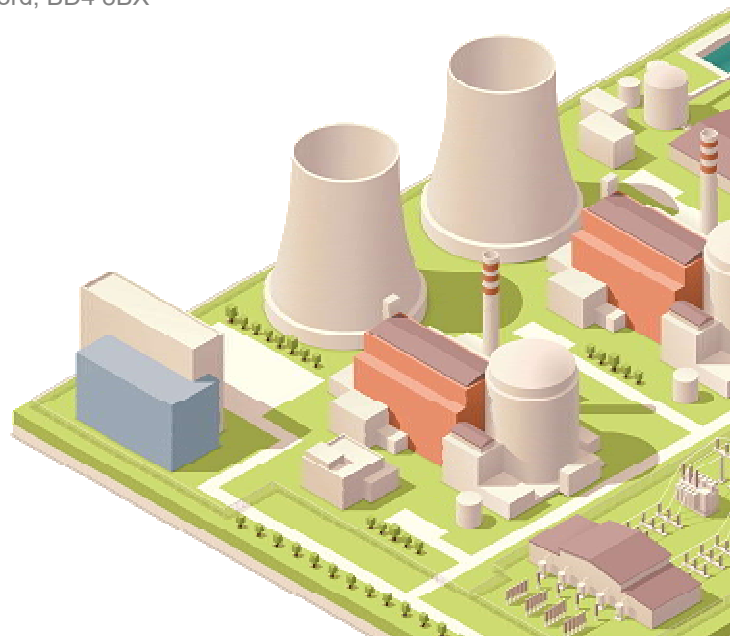
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YOUR INDUSTRY EXPERTS



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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP 31 - Carbon Filter with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP 31 - Carbon Filter
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total VOC	R1	20	3.8	1.0	273k, 101.3kPa, Wet Gas	-	90.7	23.1	06/08/2024	13:00-13:30
Volumetric Flow (Actual)	R1	-	25,419 m³/h	1153	As Measured	-	-	-	06/08/2024	10:48-10:56
Volumetric Flow (REF)	R1	-	23,590 m³/h	1070	273k, 101.3kPa, Wet Gas	-	-	-	06/08/2024	10:48-10:56

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Carbon Filter
Continuous or Batch Process	Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	Unheated sampling was necessary due to sampling location restrictions, therefore the result should be be considered indicative

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			

Envirocare: 2522

Equipment Checklist

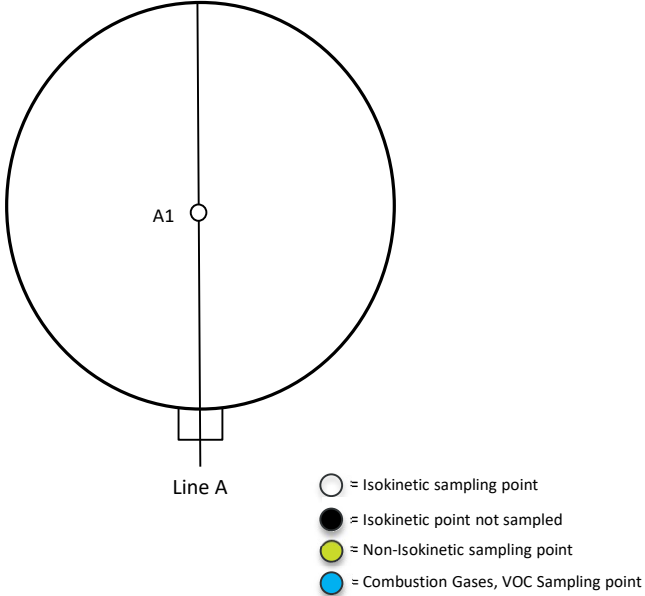
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	SK-Thermo FID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	7.13	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP 31 - Carbon Filter Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	1.00
Width	m	-
Area	m²	0.8
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Horizontal
Sampling Port Size	-	Hole
Number of Ports	-	3

Manual Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Permanent
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	N/A
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	N/A
	Platform has chains / self closing gates at top of ladders	N/A
	Platform has adequate drainage to prevent accumulation of free-standing water	N/A
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
	Gaps between handrails not >0,5m	N/A
Access	Platform has vertical base boards (approx. 0.25m high)	N/A
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
1.00	0.8	1009	19.0	21.0	10.0	0.5	30.4	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	14.6	70.1	72.3	71.3	71.2	9.0	20	3
	A2	85.4	72.1	72.9	69.8	71.6	9.0	20	3

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	14.6	73.4	72.9	74.5	73.6	8.8	0	3
	B2	85.4	74.3	71.0	76.3	73.9	8.8	0	4

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	9.0	1.0:1	20	293	25419	23590	23590
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Instrumental Gas Analyser Calibrations

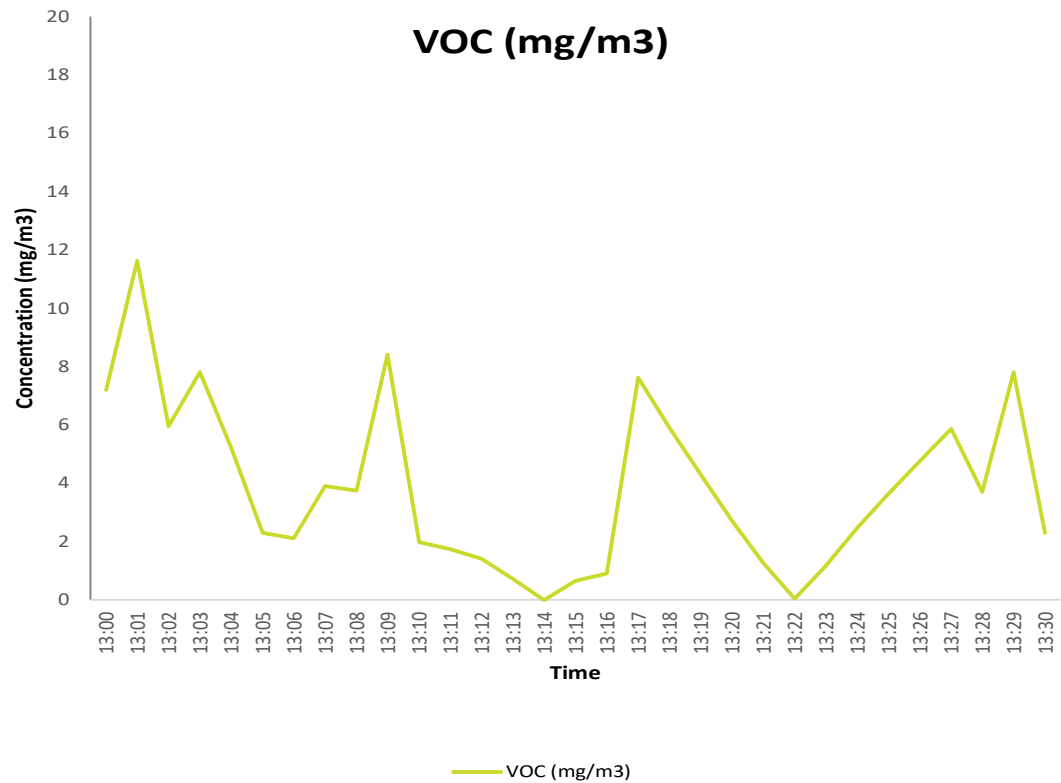
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
06/08/2024	LH JD	-	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	77.4ppm	100ppm	35	79.6	0.00	78.4	0.00	78.2	0.00	-1.77	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	3.84	11.62	0.00	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	20	mg/m³	C ₃ H ₈
Reading	2.39	ppm	
Span Gas Certified Value	77.4	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.000	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	0.17	Rectangular	1.73	0.10	0.01
Linearity (% of value)	0.24	Rectangular	1.73	0.003	0.00001
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.01	0.00007
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.01	0.0002
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.09
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.31
Expanded Total Uncertainty (ppm) (95% confidence)					0.60
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					25.0
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.0
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					4.8

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	25419	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.032	-
Standard Uncertainty - Mean Velocity	0.13	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.25	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	2.7	%
Standard Uncertainty - Volumetric Flow Rate	588	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	1153	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP 18 - Spray Booth 18

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 7th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-0123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



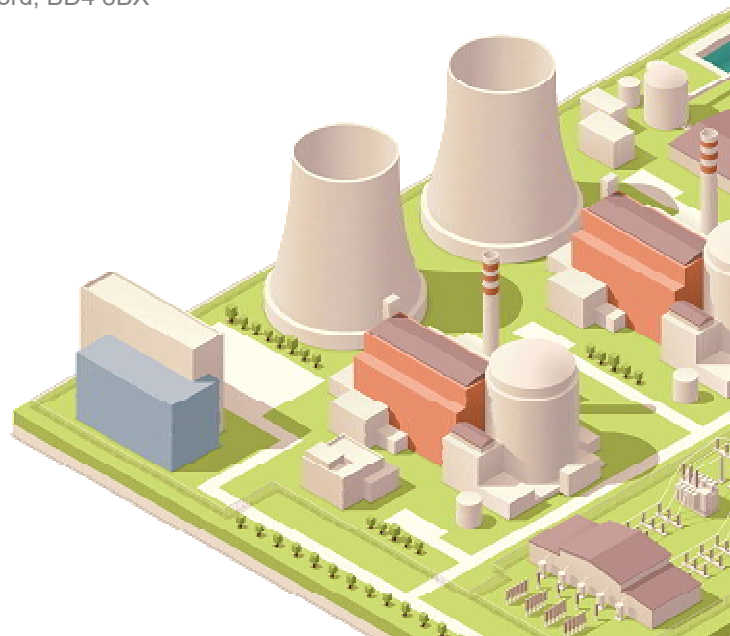
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YOUR INDUSTRY EXPERTS



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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP 18 - Spray Booth 18 with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP 18 - Spray Booth 18
Total Particulate Matter	✓
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

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Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	50	2.8	0.55	273k, 101.3kPa, Wet Gas	-	36.1	7.4	07/08/2024	11:00-11:32
Total VOC	R1	50	2.3	1.1	273k, 101.3kPa, Wet Gas	-	30.3	13.8	07/08/2024	11:00-11:32
Volumetric Flow (Actual)	R1	-	13,868 m³/h	629	As Measured	-	-	-	07/08/2024	09:50-10:10
Volumetric Flow (REF)	R1	-	12,985 m³/h	589	273k, 101.3kPa, Wet Gas	-	-	-	07/08/2024	09:50-10:10

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Spray Booth 18
Continuous or Batch Process	Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

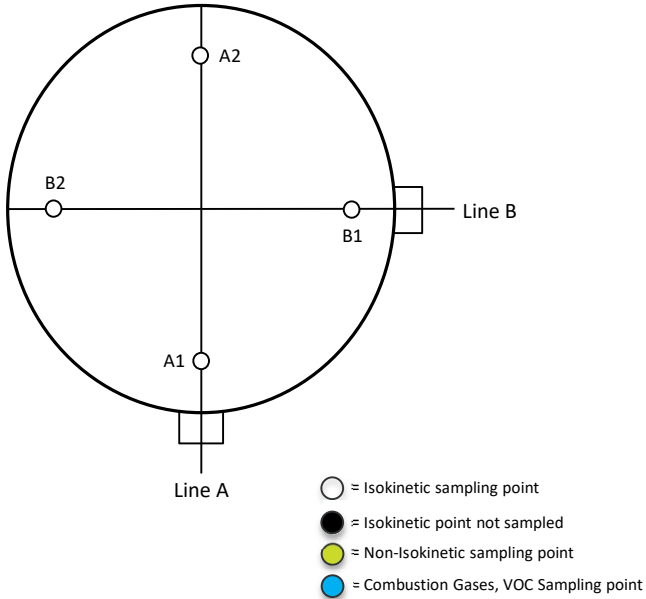
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	ETC-S-12:13	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	Testo iFID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP 18 - Spray Booth 18 Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.60
Width	m	-
Area	m ²	0.3
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2

Platform Type and Location	
Platform Type - Permanent / Temporary	Temporary
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.60	0.3	1011	18.0	21.0	10.0	0.8	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	8.8	164.5	166.8	165.9	165.7	13.6	18	3
	A2	51.2	162.3	165.4	166.8	164.8	13.6	18	3

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	8.8	167.4	168.3	170.1	168.6	13.8	18	3
	B2	51.2	168.4	164.9	172.5	168.6	13.8	18	4

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	13.6	1.0:1	18	291	13868	12985	12985
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.088	-
Pitot Coefficient	.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	1.0	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	17.6	°C
Average Stack Temperature	21	°C
Average Stack Velocity	9.1	m/s
Isokineticity	104.9	%
Total Sampling Time	32	min
Gas Meter Difference	465	L
Corrected Gas Meter Volume	506	L
Mean Sampling Rate	15.8	L/min

Date	Operators
07/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1011	1011	mbar
Ambient Temperature	18.0	18.0	°C
Leak Check	0.00	-	L/min
Time	11:00	11:32	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.474	Nm ³
Gas Meter Volume (REF)	0.478	Nm ³
Stack Gas Water Vapour Content	0.8	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	2.8	mg/Nm ³
TPM Mass Emissions (REF)	36	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-7142	47mm GFA	0.03	0.29	0.32
1	PR-47-7134	47mm GFA	0.63	0.70	1.33

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1454.1	1267.0	1210.7	1434.0	3.2
	After	1456.2	1267.5	1210.9	1434.4	

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Overall Blank Value (OBV)	0.67	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	19/08/2024
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

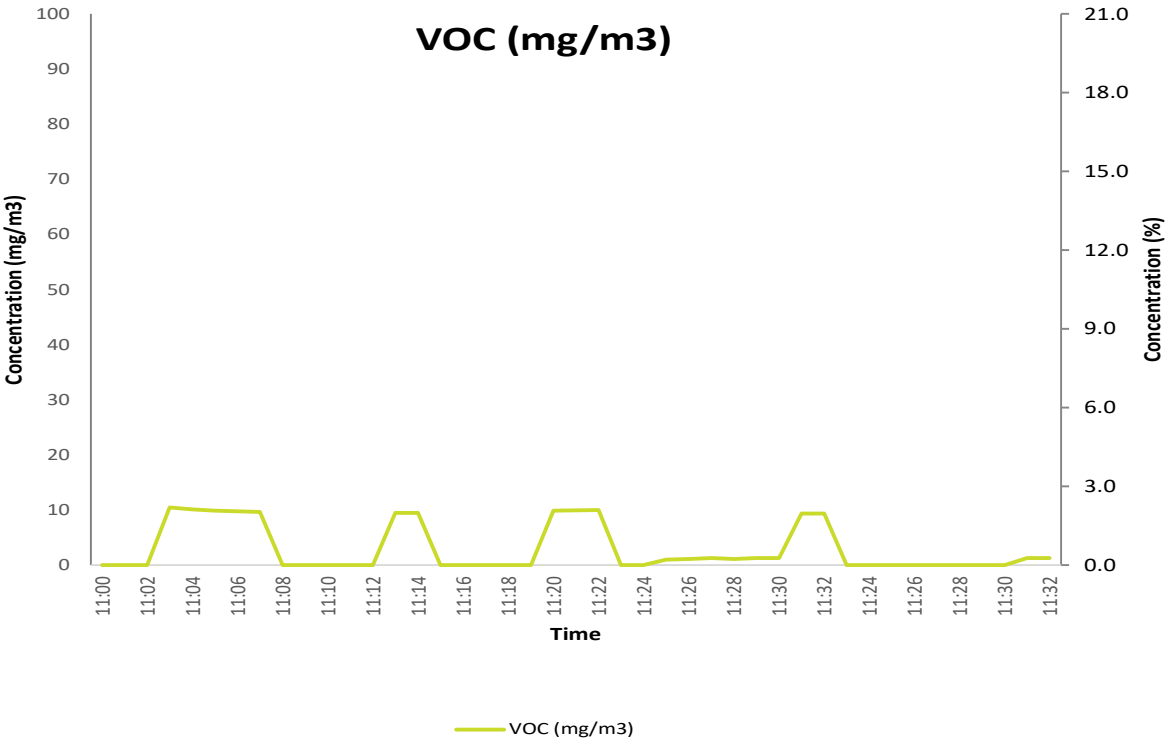
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
07/08/2024	LH JD	0.00	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	77.4ppm	100ppm	60	76.5	0.00	77.6	0.00	77.9	0.00	1.81	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	2.34	10.00	0.00	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit	Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m³	Mean Emission Concentration	2.8	mg/m³
Mean Sampling Rate	15.8	L/min	Monitoring Duration	32	min
Leak Rate	0.00	L/min	Console ID	8.13	-
Barometric Pressure	1011	mbar	Temperature Uncertainty	0.24	°C
Average Stack Temperature	21	°C	Gas Meter Uncertainty	0.37	%
Sampled Stack Gas Volume	465	L	Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	2.5	0.28	mg	0.56	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.32	0.000	L/min	0.00	0.000	0.00000
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0008	0.0000006
Gasmeter Volume	Std	<2%	9.3	1.7	L	0.37	0.01	0.0001
Temperature	Std	1% of value	0.21	0.24	°C	1.2	0.03	0.001
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.003	0.00001
Total								0.08
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								19.9
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								1.1

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	50	mg/m³	C ₃ H ₈
Reading	1.45	ppm	
Span Gas Certified Value	77.4	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.000	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	-0.30	Rectangular	1.73	-0.17	0.03
Linearity (% of value)	0.24	Rectangular	1.73	0.002	0.000004
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.005	0.00003
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.008	0.0001
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.11
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.34
Expanded Total Uncertainty (ppm) (95% confidence)					0.66
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					45
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					2.1

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	13868	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.035	-
Standard Uncertainty - Mean Velocity	0.21	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.41	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	3.0	%
Standard Uncertainty - Volumetric Flow Rate	321	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	629	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP 19 - Spray Booth 19

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 7th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-0123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



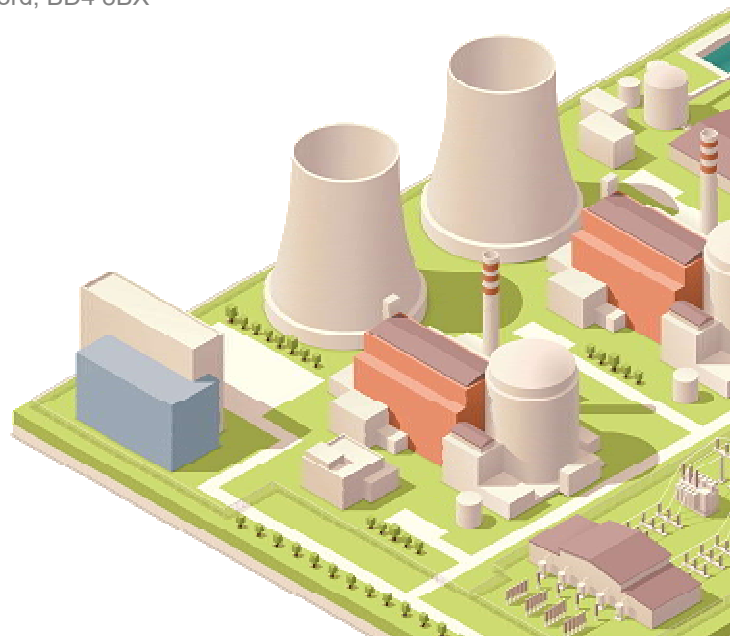
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YOUR INDUSTRY EXPERTS



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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP 19 - Spray Booth 19 with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP 19 - Spray Booth 19
Total Particulate Matter	✓
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	50	1.2	0.55	273k, 101.3kPa, Wet Gas	-	16.0	7.1	07/08/2024	11:40-12:12
Total VOC	R1	50	5.8	1.1	273k, 101.3kPa, Wet Gas	-	74	14	07/08/2024	11:40-12:12
Volumetric Flow (Actual)	R1	-	13,738 m³/h	623	As Measured	-	-	-	07/08/2024	10:20-10:30
Volumetric Flow (REF)	R1	-	12,775 m³/h	579	273k, 101.3kPa, Wet Gas	-	-	-	07/08/2024	10:20-10:30

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Spray Booth 19
Continuous or Batch Process	Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

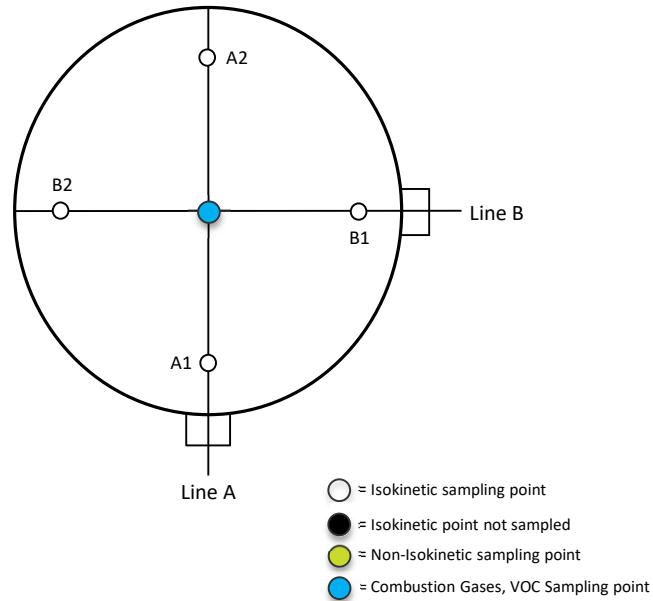
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	Testo iFID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP 19 - Spray Booth 19 Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.60
Width	m	-
Area	m ²	0.3
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 4
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Temporary
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.60	0.3	1011	18.0	21.0	10.0	1.0	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	8.8	160.4	161.8	160.3	160.8	13.5	20	3
	A2	51.2	162.5	159.7	161.0	161.1	13.5	20	3

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	8.8	162.1	162.3	159.7	161.4	13.0	0	3
	B2	51.2	161.4	162.1	159.3	160.9	13.0	0	3

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	13.5	1.0:1	20	293	13738	12775	12775
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.088	-
Pitot Coefficient	.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	1.0	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	21.8	°C
Average Stack Temperature	20	°C
Average Stack Velocity	11.5	m/s
Isokineticity	106.1	%
Total Sampling Time	32	min
Gas Meter Difference	607	L
Corrected Gas Meter Volume	660	L
Mean Sampling Rate	20.6	L/min

Date	Operators
07/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1011	1011	mbar
Ambient Temperature	18.0	18.0	°C
Leak Check	0.00	-	L/min
Time	11:40	12:12	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.610	Nm ³
Gas Meter Volume (REF)	0.616	Nm ³
Stack Gas Water Vapour Content	1.0	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	1.2	mg/Nm ³
TPM Mass Emissions (REF)	16	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-7133	47mm GFA	0.23	0.41	0.64
1	PR-47-7281	47mm GFA	0.24	0.53	0.77

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1456.2	1267.5	1210.9	1434.4	6.2
	After	1460.3	1268.5	1211.5	1434.9	

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Overall Blank Value (OBV)	1.04	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	INPUT
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

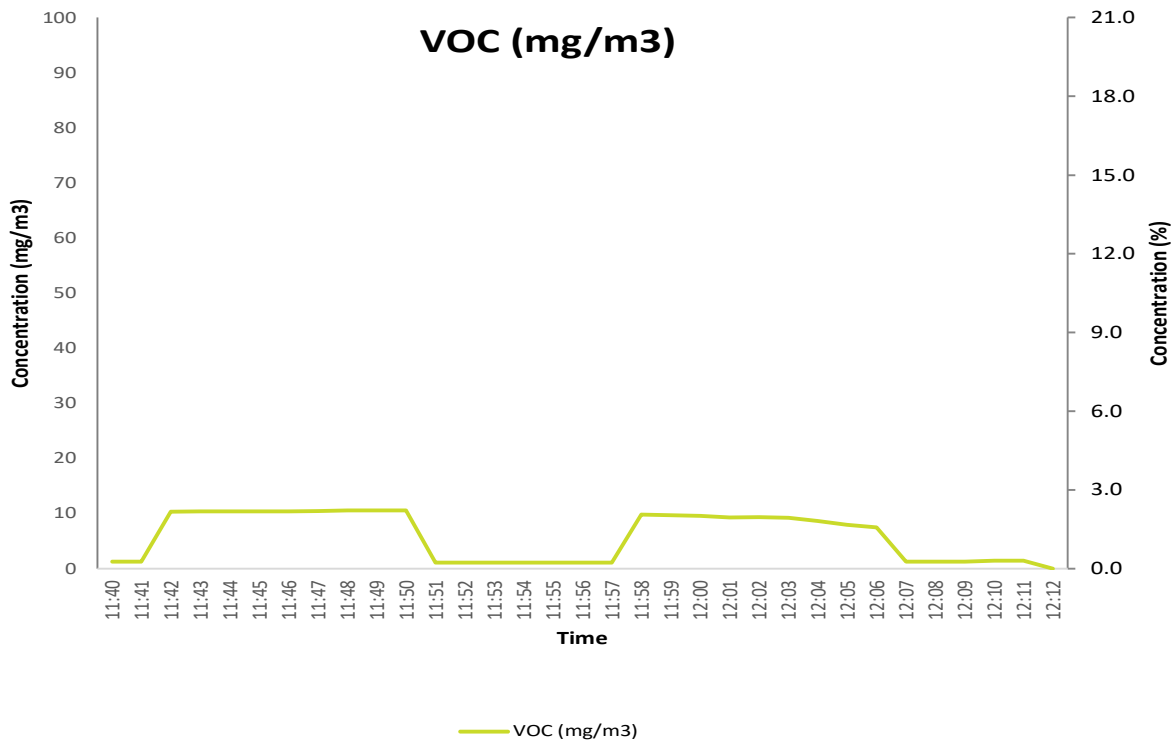
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
07/08/2024	LH JD	0.00	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	77.4ppm	100ppm	60	76.5	0.00	77.6	0.00	77.9	0.00	1.81	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	5.83	0.00	0.00	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit	Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m³	Mean Emission Concentration	1.2	mg/m³
Mean Sampling Rate	20.6	L/min	Monitoring Duration	32	min
Leak Rate	0.00	L/min	Console ID	8.13	-
Barometric Pressure	1011	mbar	Temperature Uncertainty	0.24	°C
Average Stack Temperature	20	°C	Gas Meter Uncertainty	0.37	%
Sampled Stack Gas Volume	607	L	Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	2.5	0.28	mg	0.6	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.41	0.00	L/min	0.00	0.000	0.00000
Time	Std	1sec in 1hour = 0.028%	2.0	0.5	sec	0.03	0.0003	0.0000001
Gasmeter Volume	Std	<2%	12.1	2.2	L	0.37	0.0046	0.000021
Temperature	Std	1% of value	0.2	0.24	°C	1.19	0.015	0.00022
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.001	0.00000
Total								0.08
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								44.0
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								1.1

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	50	mg/m³	C ₃ H ₈
Reading	3.63	ppm	
Span Gas Certified Value	77.4	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	-0.30	Rectangular	1.73	-0.17	0.03
Linearity (% of value)	0.24	Rectangular	1.73	0.005	0.00003
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.01	0.0002
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.02	0.0004
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.11
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.34
Expanded Total Uncertainty (ppm) (95% confidence)					0.66
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					18.2
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					2.1

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	13738	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.032	-
Standard Uncertainty - Mean Velocity	0.19	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.37	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	2.7	%
Standard Uncertainty - Volumetric Flow Rate	318	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	623	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP 20 - Spray Booth 20

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 7th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-0123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



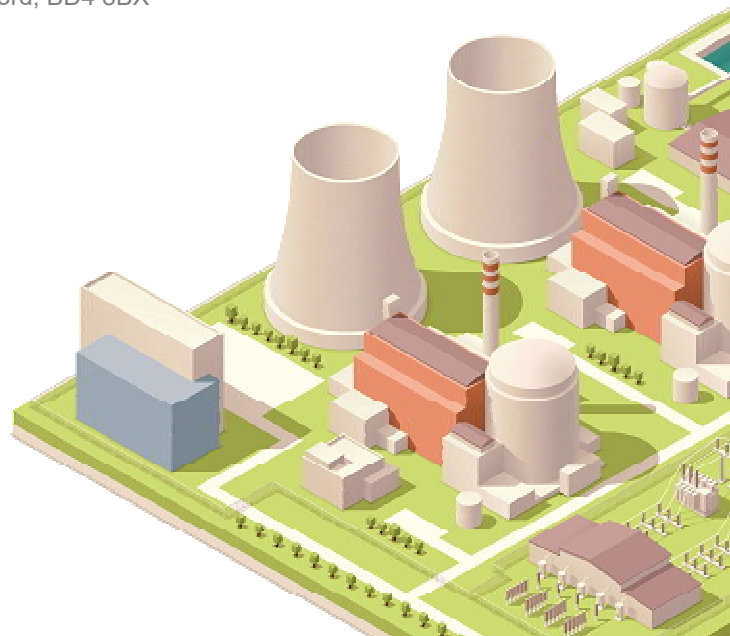
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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP 20 - Spray Booth 20 with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP 20 - Spray Booth 20
Total Particulate Matter	✓
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	50	4.2	0.55	273k, 101.3kPa, Wet Gas	-	6	0.8	07/08/2024	12:23-12:55
Total VOC	R1	50	5.46	1.1	273k, 101.3kPa, Wet Gas	-	7.4	1	07/08/2024	12:23-12:55
Volumetric Flow (Actual)	R1	-	1,441 m³/h	65	As Measured	-	-	-	07/08/2024	10:32 - 10:36
Volumetric Flow (REF)	R1	-	1,349 m³/h	61	273k, 101.3kPa, Wet Gas	-	-	-	07/08/2024	10:32 - 10:36

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Spray Booth 20
Continuous or Batch Process	Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

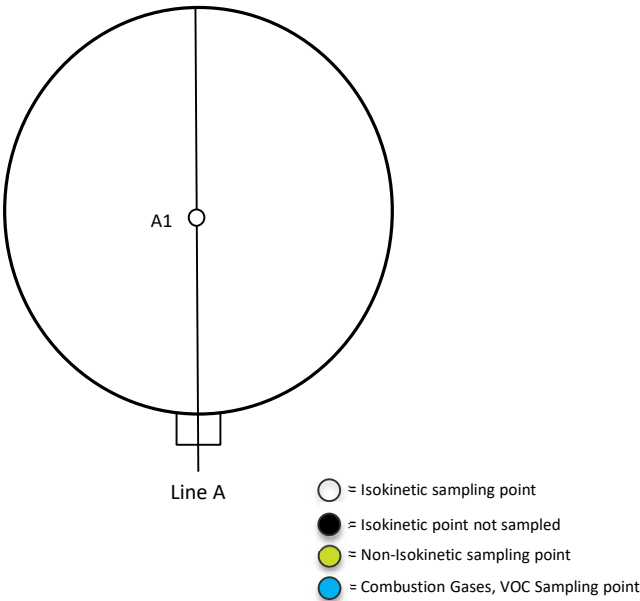
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	Testo iFID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP 20 - Spray Booth 20 Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.20
Width	m	-
Area	m ²	0.0
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	1

Manual Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Roof
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.20	0.0	1011	28.0	21.0	10.0	1.0	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	10.0	145.6	143.6	144.2	144.5	12.7	18	1

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	12.7	1.0:1	18	291	1441	1349	1349
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.088	-
Pitot Coefficient	.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	1.1	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	23.8	°C
Average Stack Temperature	27	°C
Average Stack Velocity	5.8	m/s
Isokineticity	105.9	%
Total Sampling Time	32	min
Gas Meter Difference	300	L
Corrected Gas Meter Volume	326	L
Mean Sampling Rate	10.2	L/min

Date	Operators
07/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1011	1011	mbar
Ambient Temperature	18.0	18.0	°C
Leak Check	0.00	-	L/min
Time	12:23	12:55	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.299	Nm ³
Gas Meter Volume (REF)	0.303	Nm ³
Stack Gas Water Vapour Content	1.0	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	4.2	mg/Nm ³
TPM Mass Emissions (REF)	6	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-7131	47mm GFA	0.07	0.53	0.60
1	PR-47-7132	47mm GFA	0.46	0.81	1.27

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1460.3	1268.5	1211.5	1434.9	3.4
	After	1462.0	1269.1	1211.8	1435.7	

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Overall Blank Value (OBV)	1.98	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	18/08/2024
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

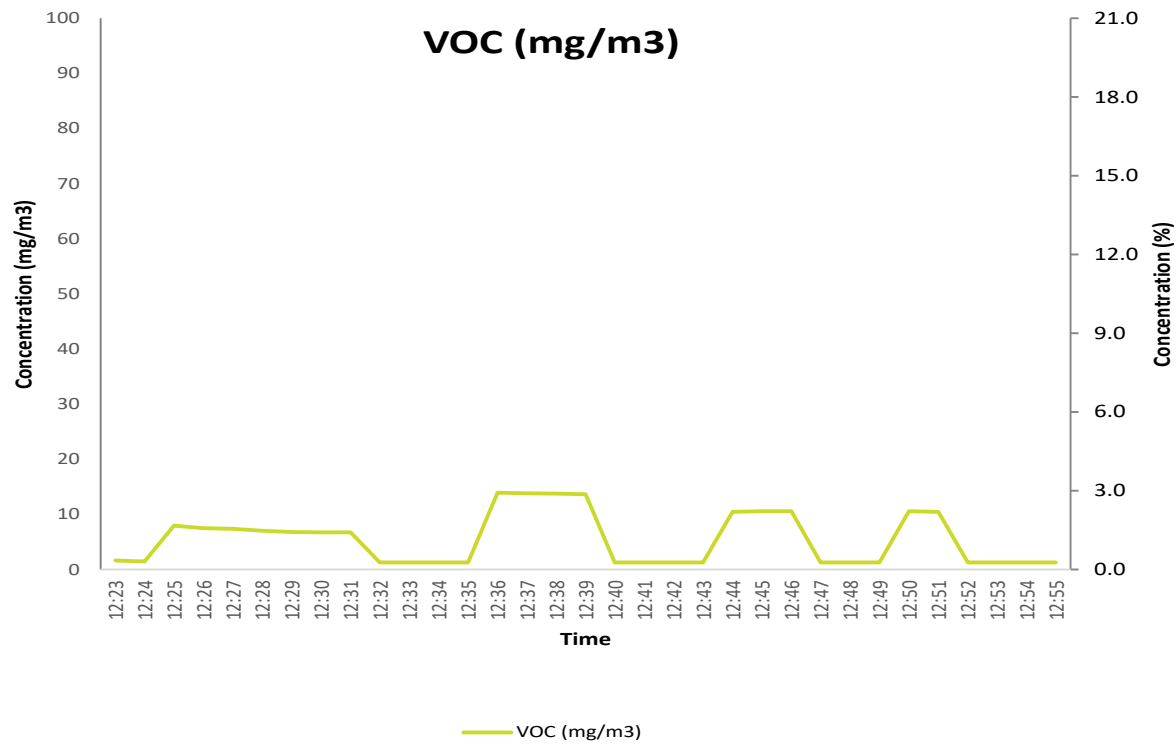
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
07/08/2024	LH JD	0.00	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	77.4ppm	100ppm	60	76.5	0.00	77.6	0.00	77.9	0.00	1.81	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	5.46	13.92	1.29	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit	Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m³	Mean Emission Concentration	4.2	mg/m³
Mean Sampling Rate	10.2	L/min	Monitoring Duration	32	min
Leak Rate	0.00	L/min	Console ID	8.13	-
Barometric Pressure	1011	mbar	Temperature Uncertainty	0.24	°C
Average Stack Temperature	27	°C	Gas Meter Uncertainty	0.37	%
Sampled Stack Gas Volume	300	L	Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	2.5	0.28	mg	0.56	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.20	0.00	L/min	0.00	0.0000	0.00000
Time	Std	1sec in 1hour = 0.028%	2.0	0.5	sec	0.03	0.001	0.000001
Gasmeter Volume	Std	<2%	6.0	1.1	L	0.37	0.02	0.0002
Temperature	Std	1% of value	0.27	0.24	°C	0.88	0.04	0.001
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.004	0.00002
Total								0.08
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								13.2
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								1.1

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	50	mg/m³	C ₃ H ₈
Reading	3.40	ppm	
Span Gas Certified Value	77.4	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	-0.30	Rectangular	1.73	-0.17	0.030
Linearity (% of value)	0.24	Rectangular	1.73	0.005	0.00002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.01	0.0001
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.02	0.0004
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.11
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.34
Expanded Total Uncertainty (ppm) (95% confidence)					0.66
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					19
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					2.1

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	1441	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.035	-
Standard Uncertainty - Mean Velocity	0.19	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.38	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	3.0	%
Standard Uncertainty - Volumetric Flow Rate	33	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	65	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permali Ltd

RP 21 - Spray Booth 21

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 7th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-0123	Version:	1	Visit:	1 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



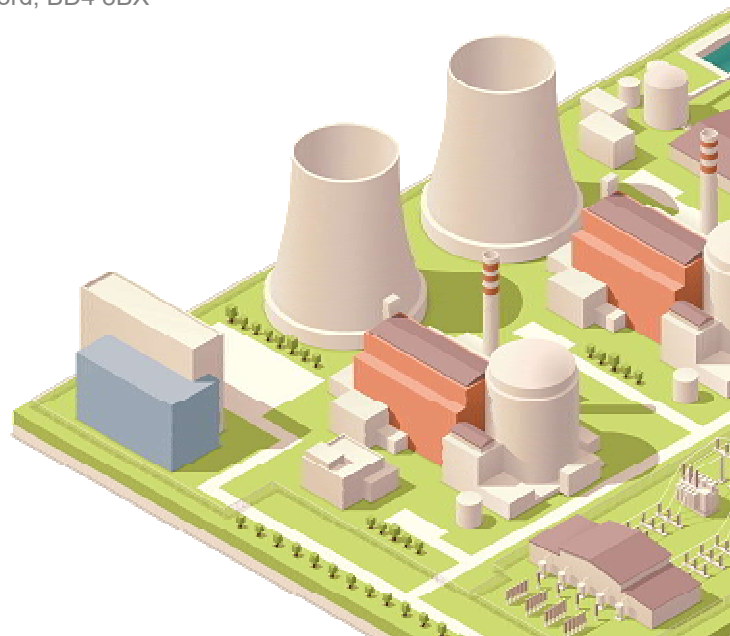
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YOUR INDUSTRY EXPERTS



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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP 21 - Spray Booth 21 with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP 21 - Spray Booth 21
Total Particulate Matter	✓
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

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Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	50	1.5	0.55	273k, 101.3kPa, Wet Gas	-	20	7.2	07/08/2024	13:00-13:32
Total VOC	R1	50	4.5	1.1	273k, 101.3kPa, Wet Gas	-	57.8	14	07/08/2024	13:00-13:32
Volumetric Flow (Actual)	R1	-	13,822 m³/h	627	As Measured	-	-	-	07/08/2024	10:43-11:00
Volumetric Flow (REF)	R1	-	12,941 m³/h	587	273k, 101.3kPa, Wet Gas	-	-	-	07/08/2024	10:43-11:00

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Spray Booth 21
Continuous or Batch Process	Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

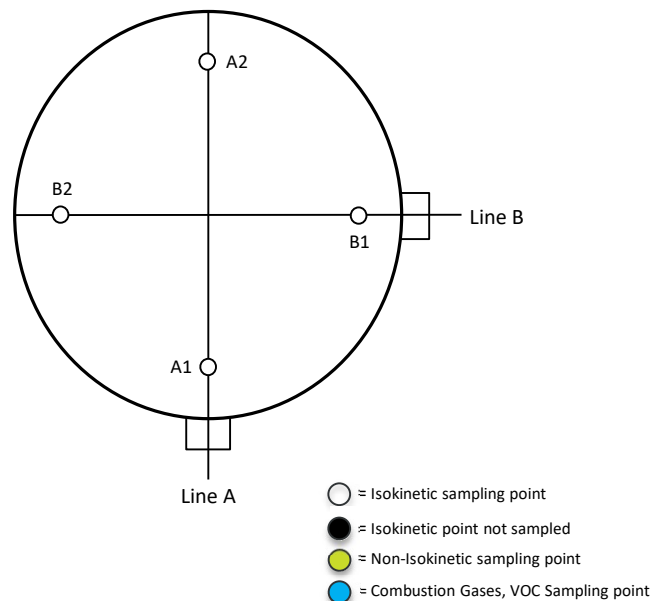
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	Testo iFID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP 21 - Spray Booth 21 Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.60
Width	m	-
Area	m ²	0.3
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Temporary
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.60	0.3	1011	28.0	21.0	10.0	1.0	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	8.8	163.2	163.9	164.2	163.8	13.6	18	4
	A2	51.2	164.3	164.9	163.8	164.3	13.6	18	4

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	8.8	162.9	163.3	162.1	162.8	13.5	19	4
	B2	51.2	163.4	164.1	162.5	163.3	13.5	18	3

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	13.6	1.0:1	18	291	13822	12941	12941
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.088	-
Pitot Coefficient	.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	1.0	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	27.3	°C
Average Stack Temperature	22	°C
Average Stack Velocity	11.7	m/s
Isokineticity	104.9	%
Total Sampling Time	32	min
Gas Meter Difference	615	L
Corrected Gas Meter Volume	669	L
Mean Sampling Rate	20.9	L/min

Date	Operators
07/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1011	1011	mbar
Ambient Temperature	18.0	18.0	°C
Leak Check	0.00	-	L/min
Time	13:00	13:32	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.607	Nm ³
Gas Meter Volume (REF)	0.613	Nm ³
Stack Gas Water Vapour Content	1.0	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	1.5	mg/Nm ³
TPM Mass Emissions (REF)	20	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-7138	47mm GFA	0.08	< 0.25	0.33
1	PR-47-7139	47mm GFA	0.33	0.62	0.95

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1462.0	1269.1	1211.8	1435.7	4.8
	After	1464.3	1270.3	1212.1	1436.7	

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Overall Blank Value (OBV)	0.54	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	18/08/2024
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

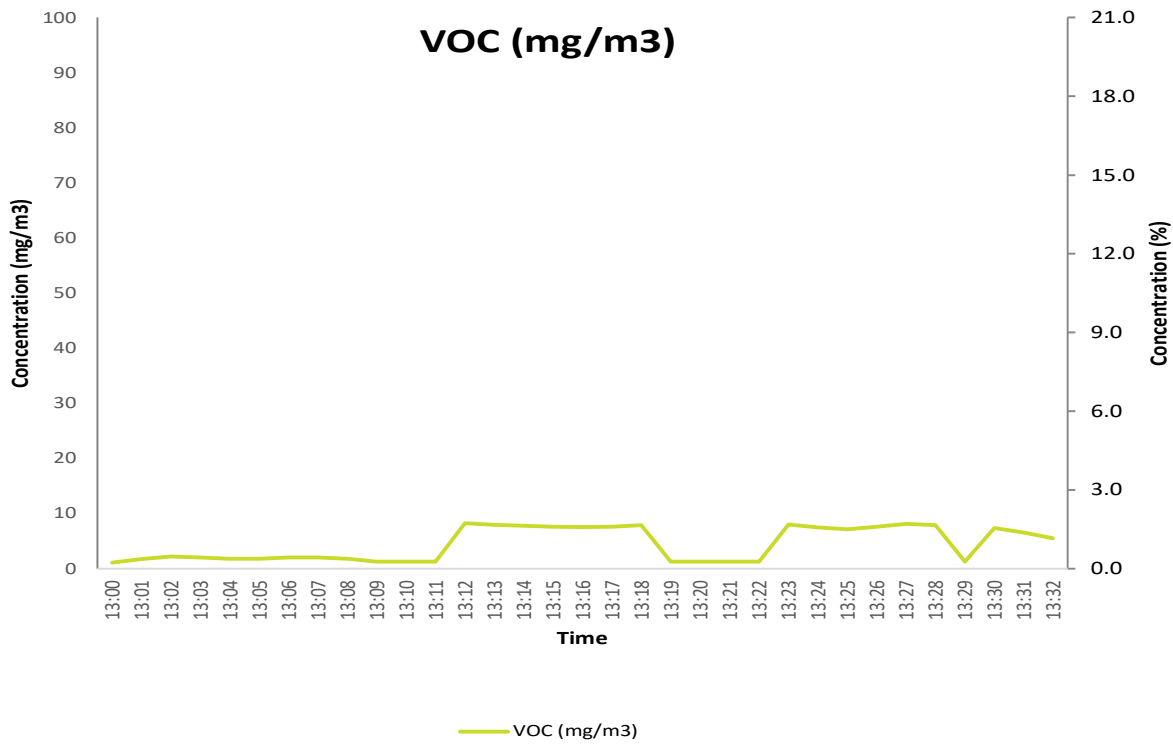
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
07/08/2024	LH JD	0.00	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	77.4ppm	100ppm	60	76.5	0.00	77.6	0.00	77.9	0.00	1.81	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	4.47	8.28	1.11	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit	Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m³	Mean Emission Concentration	1.5	mg/m³
Mean Sampling Rate	20.9	L/min	Monitoring Duration	32	min
Leak Rate	0.00	L/min	Console ID	8.13	-
Barometric Pressure	1011	mbar	Temperature Uncertainty	0.24	°C
Average Stack Temperature	22	°C	Gas Meter Uncertainty	0.37	%
Sampled Stack Gas Volume	615	L	Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	2.5	0.28	mg	0.56	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.42	0.00	L/min	0.00	0.000	0.00000
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0004	0.0000002
Gasmeter Volume	Std	<2%	12.3	2.3	L	0.37	0.01	0.00003
Temperature	Std	1% of value	0.2	0.24	°C	1.08	0.02	0.0003
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.002	0.000002
Total								0.08
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								35.5
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								1.1

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	50	mg/m³	C ₃ H ₈
Reading	2.78	ppm	
Span Gas Certified Value	77.4	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	-0.30	Rectangular	1.73	-0.17	0.030
Linearity (% of value)	0.24	Rectangular	1.73	0.004	0.00001
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.01	0.00009
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.02	0.0003
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.11
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.34
Expanded Total Uncertainty (ppm) (95% confidence)					0.66
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					24
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					2.1

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	13822	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.035	-
Standard Uncertainty - Mean Velocity	0.21	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.40	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	3.0	%
Standard Uncertainty - Volumetric Flow Rate	320	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	627	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP 22 - Spray Booth 22

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 7th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-0123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2026				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



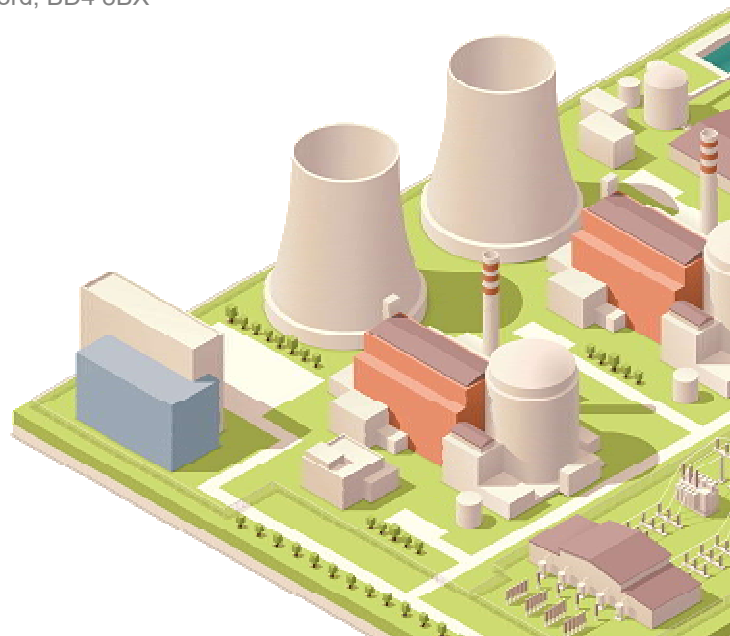
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YOUR INDUSTRY EXPERTS



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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP 22 - Spray Booth 22 with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP 22 - Spray Booth 22
Total Particulate Matter	✓
Total VOC	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	50	1.3	0.55	273k, 101.3kPa, Wet Gas	-	17.2	7.2	07/08/2024	13:40-14:12
Total VOC	R1	50	5.8	1.1	273k, 101.3kPa, Wet Gas	-	74.8	14	07/08/2024	13:40-14:12
Volumetric Flow (Actual)	R1	-	13,859 m³/h	628	As Measured	-	-	-	07/08/2024	11:10-11:30
Volumetric Flow (REF)	R1	-	12,976 m³/h	588	273k, 101.3kPa, Wet Gas	-	-	-	07/08/2024	11:10-11:30

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Spray Booth 22
Continuous or Batch Process	Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

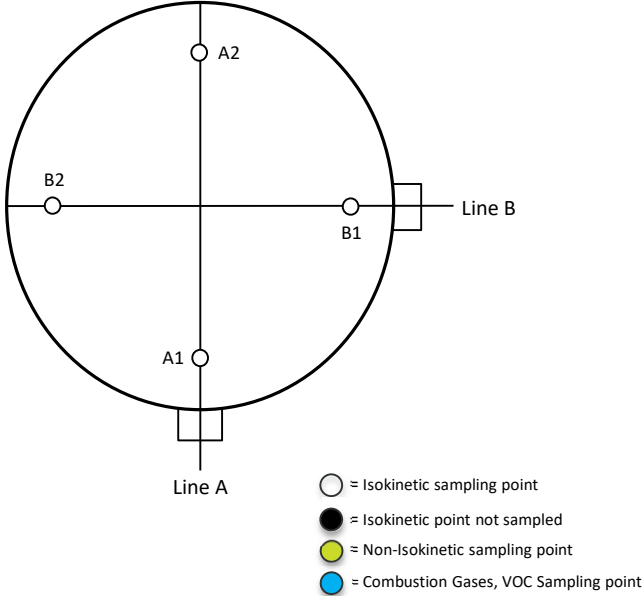
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	Testa iFID	ETC-S13.01	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP 22 - Spray Booth 22 Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.60
Width	m	-
Area	m ²	0.3
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Temporary
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.60	0.3	1011	28.0	21.0	10.0	1.0	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	8.8	162.7	165.2	167.2	165.0	13.6	18	2
	A2	51.2	162.3	165.1	167.1	164.8	13.6	18	3

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	8.8	165.1	165.8	165.8	165.6	13.6	18	3
	B2	51.2	165.6	164.9	1162.7	497.7	23.7	18	4

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	13.6	1.0:1	18	291	13859	12976	12976
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.088	-
Pitot Coefficient	.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	1.0	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	5.0	mm
Average Gas Meter Temperature	27.9	°C
Average Stack Temperature	23	°C
Average Stack Velocity	11.1	m/s
Isokineticity	102.9	%
Total Sampling Time	32	min
Gas Meter Difference	401	L
Corrected Gas Meter Volume	436	L
Mean Sampling Rate	13.6	L/min

Date	Operators
07/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1011	1011	mbar
Ambient Temperature	INPUT	INPUT	°C
Leak Check	0.00	-	L/min
Time	13:40	14:12	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.395	Nm ³
Gas Meter Volume (REF)	0.399	Nm ³
Stack Gas Water Vapour Content	1.0	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	1.3	mg/Nm ³
TPM Mass Emissions (REF)	17	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-7140	47mm GFA	< 0.03	< 0.25	< 0.28
1	PR-47-7137	47mm GFA	0.13	0.40	0.53

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1464.3	1270.3	1212.1	1436.7	4.0
	After	1466.1	1271.6	1212.9	1436.8	

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Overall Blank Value (OBV)	< 0.70	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	18/08/2024
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

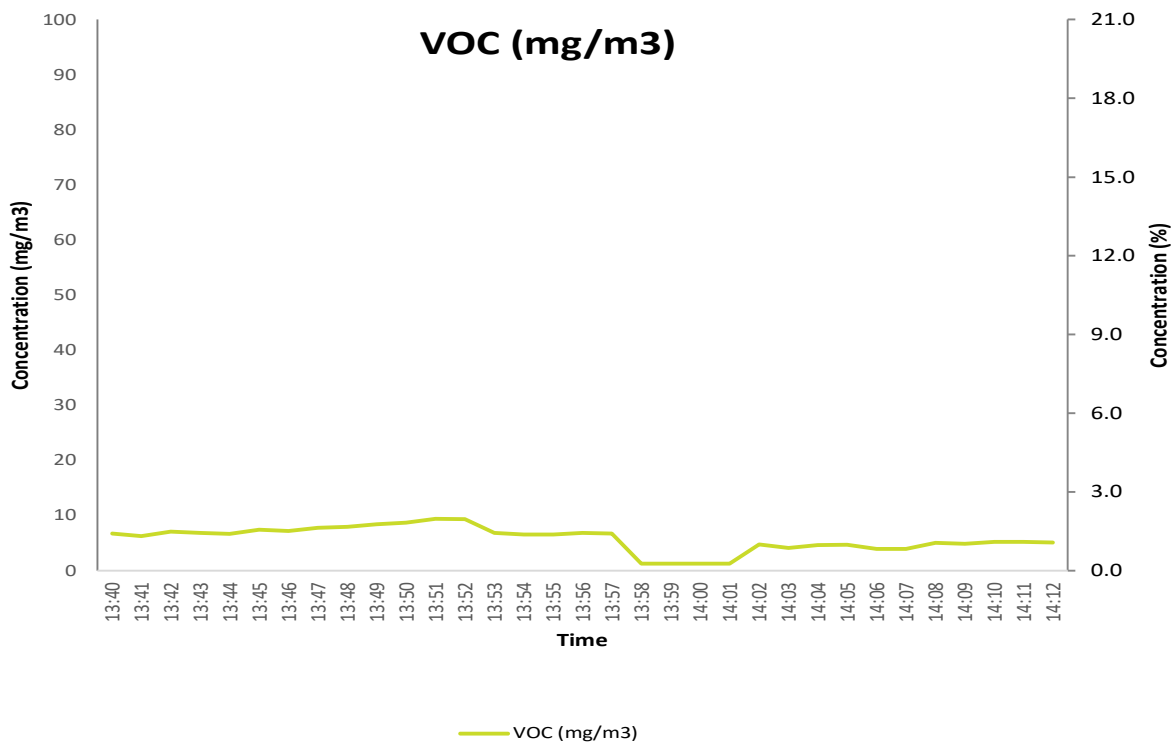
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
07/08/2024	LH JD	0.00	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	77.4ppm	100ppm	60	76.5	0.00	77.6	0.00	77.9	0.00	1.81	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	5.76	9.40	1.29	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit	Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³	Mean Emission Concentration	1.3	mg/m ³
Mean Sampling Rate	13.6	L/min	Monitoring Duration	32	min
Leak Rate	0.00	L/min	Console ID	8.13	-
Barometric Pressure	1011	mbar	Temperature Uncertainty	0.24	°C
Average Stack Temperature	23	°C	Gas Meter Uncertainty	0.37	%
Sampled Stack Gas Volume	401	L	Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	2.5	0.28	mg	0.56	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.27	0.000	L/min	0.00	0.00	0.00
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0004	0.0000001
Gasmeter Volume	Std	<2%	8.0	1.5	L	0.37	0.005	0.00002
Temperature	Std	1% of value	0.23	0.24	°C	1.1	0.01	0.0002
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.001	0.000002
Total								0.08
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								41.4
Expanded Total Uncertainty (mg/m ³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								1.1

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	50	mg/m ³	C ₃ H ₈
Reading	3.59	ppm	
Span Gas Certified Value	77.4	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	-0.30	Rectangular	1.73	-0.17	0.03
Linearity (% of value)	0.24	Rectangular	1.73	0.0050	0.00002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.01	0.0002
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.021	0.0004
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.11
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.34
Expanded Total Uncertainty (ppm) (95% confidence)					0.66
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					18
Expanded Total Uncertainty (mg/m ³) (95% confidence)					1.1
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					2.1

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	13859	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.035	-
Standard Uncertainty - Mean Velocity	0.21	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.41	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	3.0	%
Standard Uncertainty - Volumetric Flow Rate	321	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	628	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

EP1-Scrubber Inlet

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 12th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-00124	Version:	1	Visit:	2 in 2024
Date of Report:	30th August 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Ian Baggley	Function:	Training Manager		
MCERTS No:	MM 05 653	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



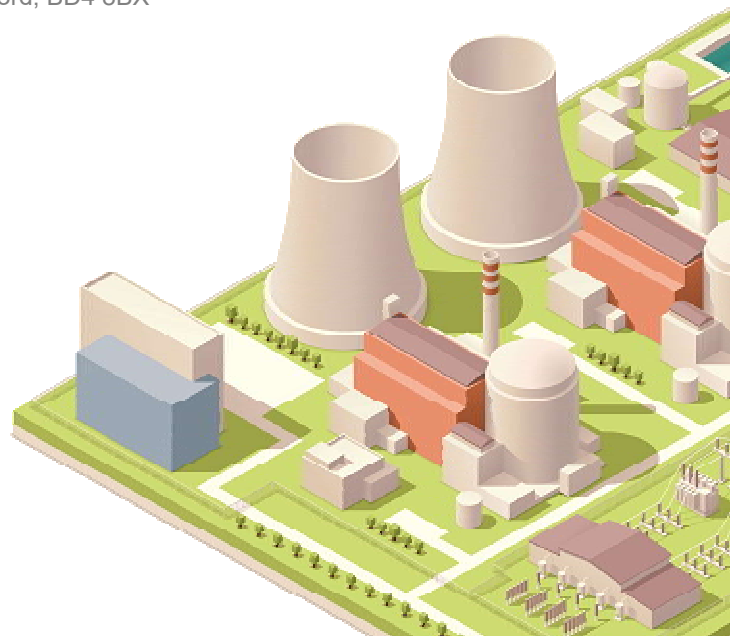
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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the release of prescribed pollutants at EP1-Scrubber Inlet . There are no emission limits set for any of the pollutants at this time. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	EP1-Scrubber Inlet
Total VOC	✓
VOC Screen	✓
Formaldehyde	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration			Reference Conditions	Mass Emission			Sampling Date	Sampling Times
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-		Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-		
Total VOC	R1	-	4.1	1.1	273k, 101.3kPa, Wet Gas	-	52.2	14.5	12/08/2024	10:41-12:43
Total Cresol	R1	-	11.1	3.0		-	140	38.9	12/08/2024	10:40-11:49
Formaldehyde	R1	-	1.1	0.09		-	13.7	1.4	12/08/2024	11:43-12:43
Volumetric Flow (Actual)	R1	-	13,368 m³/h	743	As Measured	-	-	-	12/08/2024	10:17-10:25
Volumetric Flow (REF)	R1	-	12,685 m³/h	705	273k, 101.3kPa, Wet Gas	-	-	-	12/08/2024	10:17-10:25

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Note : Phenol less than Limit of Detection

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Wet Scrubber (Water only - No caustic)
Continuous or Batch Process	Continuous - When in operation
Operating Status	Operational
Feedstock	Water - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Formaldehyde	PD CEN/TS 17638	ETC-SE-02	Yes	RPS	M103	UV-VIS	Yes
VOC Screen	PD CEN/TS 13649-1	ETC-SE-06 (a/b)	Yes	Marchwood	MSOP12	GC-MS	No
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			

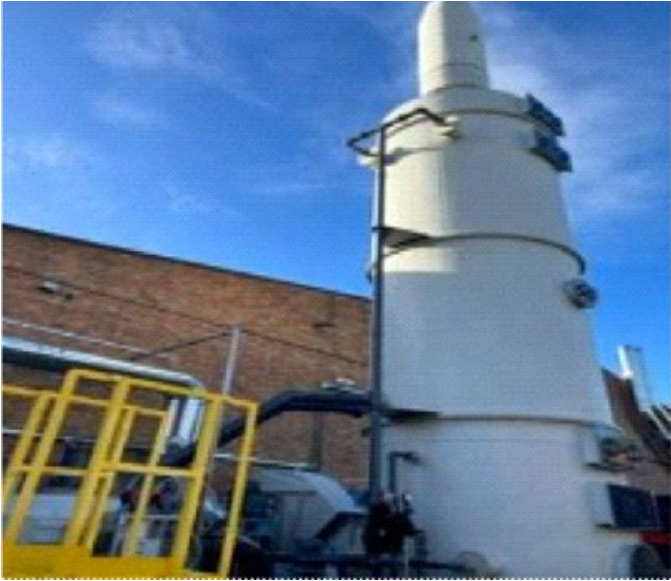
Envirocare: 2522 | RPS Laboratories Ltd (RPS): 0605 | Marchwood Scientific Services: 1668

Equipment Checklist

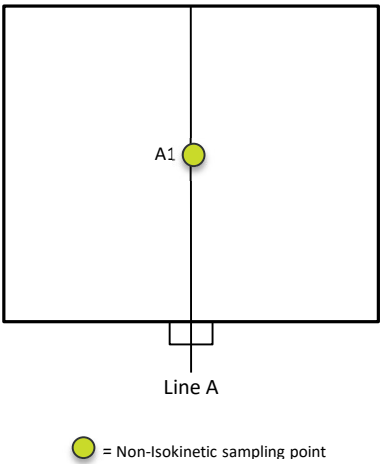
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	SK-Thermo FID	-	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: EP1-Scrubber Inlet Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Rectangular
Depth	m	0.70
Width	m	0.60
Area	m ²	0.42
Port Depth	cm	0.00
Orientation of Stack / Duct	-	Angled
Sampling Port Size	-	1" BSP
Number of Ports	-	1

Manual Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A

Platform Type and Location	
Platform Type - Permanent / Temporary	Ground Level
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	N/A
	Platform has chains / self closing gates at top of ladders	N/A
Fall Prevention	Platform has adequate drainage to prevent accumulation of free-standing water	N/A
	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
	Gaps between handrails not >0,5m	N/A
Access	Platform has vertical base boards (approx. 0.25m high)	N/A
	Access to sampling ports unhindered by obstructions	No
	Easy & safe access and egress available	No

Sampling Location / Platform Recommendations

Although the platform does not meet the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, it is adequate for the monitoring specified in the Site Specific Protocol.

Flow Criteria Measurements

Duct Dimensions (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.6 x 0.7	0.4	1007	26.0	21.0	10.0	1.7	29.8	0.848

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	8.8	68.9	67.6	69.4	68.6	8.8	13	2
	A2	26.3	67.5	68.9	69.2	68.5	8.8	13	2
	A3	43.8	66.5	67.5	70.0	68.0	8.8	13	3
	A4	61.3	70.0	70.0	68.8	69.6	8.9	13	3

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	8.8	1.0:1	13	286	13368	12685	12685
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Instrumental Gas Analyser Calibrations

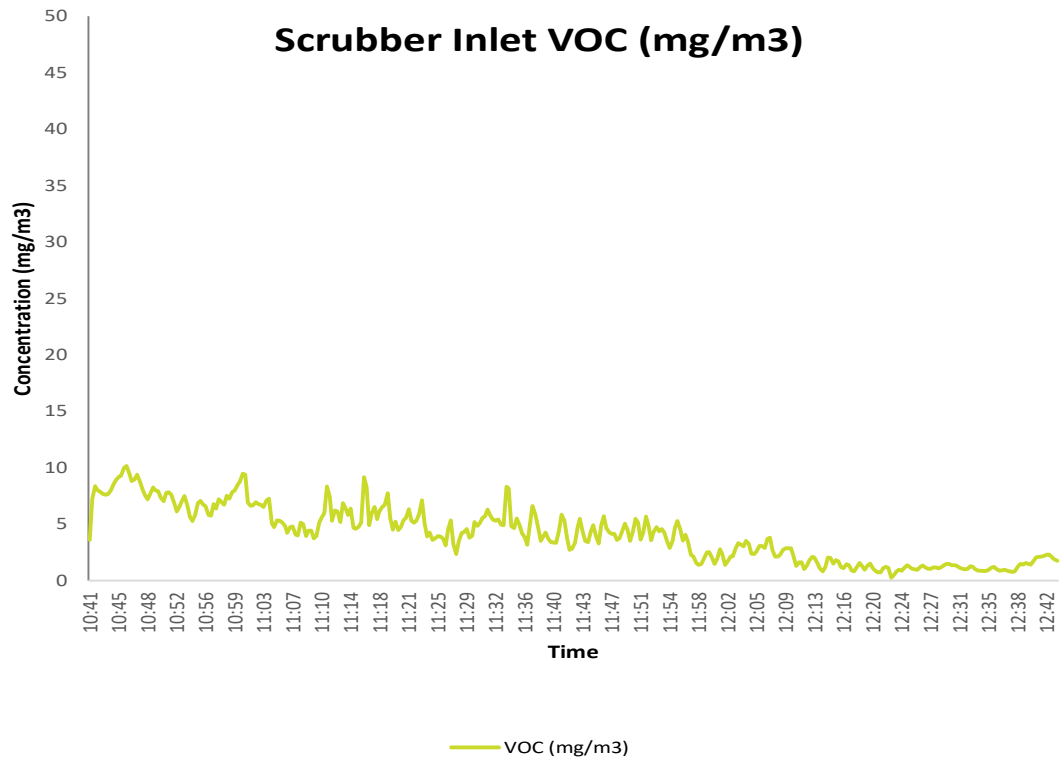
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
12/08/2024	LH JD	-	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	81.54ppm	100ppm	35	81.6	0.00	81.3	0.20	81.0	0.25	-0.98	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	4.12	10.16	0.26	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



VOC Screen - Run 1

Sampling Details		
Collection Media	226-95	-
Sampling Rate	179	mL/min
Test Duration	69	min
Sample Volume	13.46	L
Corrected Sample Volume	12.38	NL
Temperature at Tube	24.5	°C

Date	Operators
12/08/2024	LH JD

Parameter	Value	Unit
Barometric Pressure	1007	mbar
Operating Temperature	27.0	°C
Time	10:40	11:49

Species	1st Media Conc. (ug)	2nd Media Conc. (ug)	Collection Efficiency	Blank Media Conc. (ug)	Blank Conc. (mg/m3)	Emission (mg/m3)	Emission (as Carbon) (mg/m3)
Phenol	< 3	< 1	100%	< 1	< 0.08	< 0.32	-
Total Cresol	130	< 3	100%	< 3	< 0.24	10.74	-
Total			100%		< 0.32	11.06	-

Formaldehyde - Run 1 Calculations

Sampling Details		
Meter Box Number	8.03(B)	-
Gas Meter Coefficient	0.968	-
Pitot Coefficient	0.844	-
Stack Gas Molecular Weight	29.0	g/mole
Static Pressure in Stack	1.0	cmH ₂ O

Date	Operators
12/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1007	1007	mbar
Ambient Temperature	27.0	28.0	°C
Leak Check	0.00	0.00	L/min
Time	11:43	12:43	-

Analysis Details		
Collection Media	De-ionised Water	
1st Collector Reference	Imp ABC	
1st Collector Concentration	246.16	µg
2nd Collector Reference	Imp D	
2nd Collector Concentration	<19.49	µg
Has breakthrough occurred?	No	-
Overall Blank Value (OBV)	< 0.126	mg/Nm ³
OBV <10% of ELV?	N/A	-

Emissions Calculations		
Total Sampling Time	60	min
Gas Meter Difference	265.6	L
Corrected Gas Meter Volume	257.1	L
Mean Sampling Rate	4.3	L/min
Gas Meter Volume (STP Dry)	0.241	Nm ³
Gas Meter Volume (REF)	0.245	Nm ³
Stack Gas Water Vapour Content	1.7	% v/v
Stack Gas Oxygen Content	N/A	% v/v
Emission Limit Value	N/A	mg/Nm ³
Concentration (REF)	1.1	mg/Nm ³
Mass Emissions (REF)	14	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Isokineticity Details		
Nozzle Diameter	-	mm
Average Gas Meter Temperature	16.5	°C
Average Stack Temperature	15	°C
Average Stack Velocity	-	m/s
Isokineticity	-	%

Uncertainty

Uncertainty of VOC Screen - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	N/A	mg/m ³
Mean Sampling Rate	0.2	L/min
Barometric Pressure	1007	mbar

Parameter	Value	Unit
Emission Concentration	11.06	mg/m ³
Monitoring Duration	69	min
Average Stack Temperature	15	°C

Source of Uncertainty	Uncertainty Criteria	Actual Source Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
Analysis	25% of result (95% confidence)	1.38	mg	12.5	1.4	1.9
Leak Rate	<2% of sampling rate	0.01	L/min	5.57	0.22	0.05
Time	1 minute	0.50	min	0.01	0.001	0.000002
Sampling Flow Rate	2% of value	0.01	L/min	5.57	0.62	0.38
Temperature	1% of value	0.50	°C	0.17	0.02	0.0004
Pressure	1% of value	5.0	mbar	0.50	0.05	0.003
Total						2.3
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$						1.5
Expanded Total Uncertainty as a % of emission conc. (95% confidence)						27.1
Expanded Total Uncertainty (mg/m³) (95% confidence)						3.0

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Reading	2.56	ppm
Span Gas Certified Value	81.5	ppm
Range	100	ppm

Cal Gas
C ₃ H ₈

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.20	Rectangular	1.73	-0.12	0.01
Span Drift (ppm)	0.30	Rectangular	1.73	0.17	0.03
Linearity (% of value)	0.82	Rectangular	1.73	0.01	0.0001
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.009	0.00008
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.01	0.0002
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.13
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.36
Expanded Total Uncertainty (ppm) (95% confidence)					0.70
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					27
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1

Uncertainty of Formaldehyde - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	N/A	mg/m³
Mean Sampling Rate	4.3	L/min
Leak Rate	0.00	L/min
Barometric Pressure	1007	mbar
Average Stack Temperature	15	°C
Sampled Stack Gas Volume	266	L

Parameter	Value	Unit
Mean Emission Concentration	1.08	mg/m³
Monitoring Duration	60	min
Console ID	8.03(B)	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	PD CEN/TS 17638		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	7.9	%	4.0	0.04	0.002
Leak Rate	Rect	<2% of sampling rate	0.09	0.000	L/min	0.000	0.000	0.000
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.0003	0.0000009
Gasmeter Volume	Std	<2% actual volume	5.3	0.98	L	0.37	0.004	0.00002
Temperature	Std	<1% absolute temperature	0.15	0.24	k	1.6	0.02	0.0003
Pressure	Std	<1% absolute pressure	10.1	1.0	mbar	0.10	0.001	0.000001
Total								0.002
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.05
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								8.5
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.09

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	13368	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.05	-
Standard Uncertainty - Mean Velocity	0.18	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.35	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	4.0	%
Standard Uncertainty - Volumetric Flow Rate	379	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	743	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	5.6	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd Scrubber Outlet

Permit No: EPR 23/00006/A2
Installation: Gloucetser
Monitoring Dates: 12th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-00124	Version:	1	Visit:	2 in 2024
Date of Report:	4th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)

Signed:



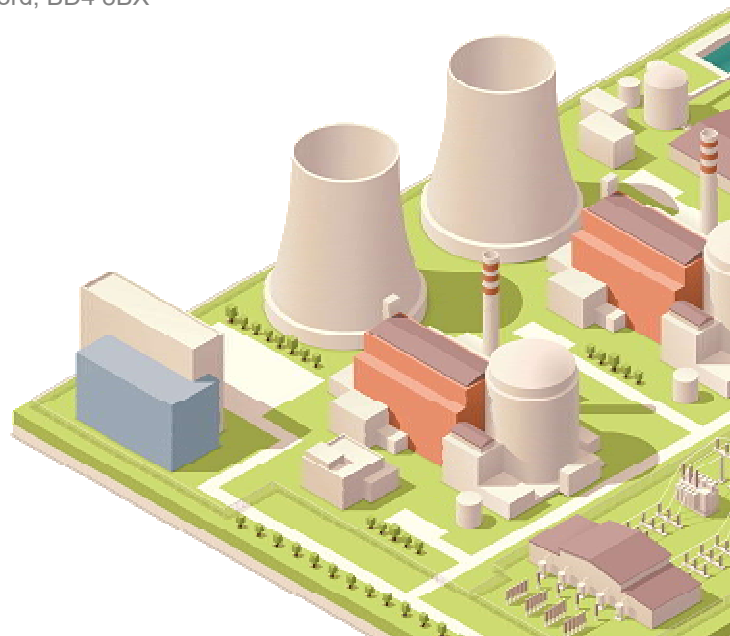
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YOUR INDUSTRY EXPERTS



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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of Scrubber Outlet with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	Scrubber Outlet
Total VOC	✓
VOC Screen	✓
Formaldehyde	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration			Reference Conditions	Mass Emission			Sampling Date	Sampling Times
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-		Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-		
Total VOC	R1	-	1.3	1.1	273k, 101.3kPa, Wet Gas	-	5.4	4.6	12/08/2024	13:29-15:35
Total Cresol	R1	N/A	3.6	0.91		-	15.0	3.8	12/08/2024	13:30-14:30
Formaldehyde	R1	N/A	< 0.02	0.002		-	< 0.07	0.01	12/08/2024	14:35-15:35
Volumetric Flow (Actual)	R1	-	4,377 m³/h	199	As Measured	-	-	-	12/08/2024	13:04-13:11
Volumetric Flow (REF)	R1	-	4,124 m³/h	187	273k, 101.3kPa, Wet Gas	-	-	-	12/08/2024	13:04-13:11

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Note : Phenol less than Limit of Detection

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Wet Scrubber (Water only - No caustic)
Continuous or Batch Process	Continuous - When in operation
Operating Status	Operational
Feedstock	Water - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	None Visible

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Formaldehyde	PD CEN/TS 17638	ETC-SE-02	Yes	RPS	M103	UV-VIS	Yes
VOC Screen	PD CEN/TS 13649-1	ETC-SE-06 (a/b)	Yes	Marchwood	MSOP12	GC-MS	No
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			

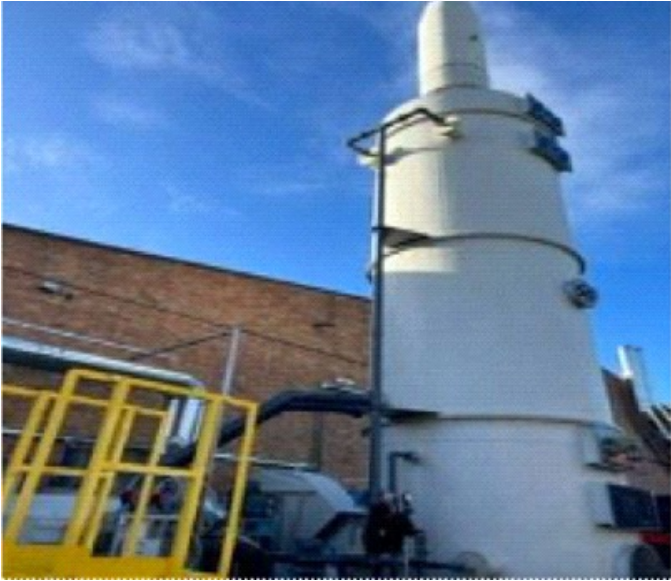
Envirocare: 2522 | RPS Laboratories Ltd (RPS): 0605 | Marchwood Scientific Services: 1668

Equipment Checklist

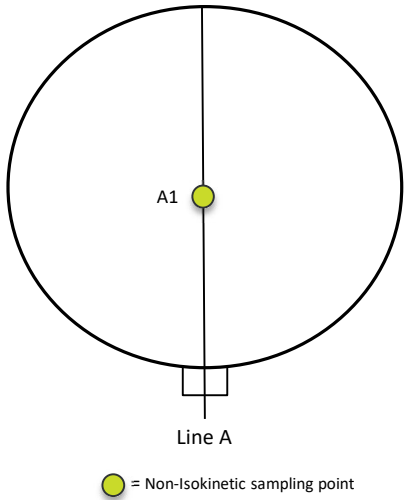
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	SK-Thermo FID	iFID	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: Scrubber Outlet Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.50
Width	m	-
Area	m ²	0.20
Port Depth	cm	0.00
Orientation of Stack / Duct	-	Angled
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	1 / 2
Number of Sampling Points	1 / 2
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A

Platform Type and Location	
Platform Type - Permanent / Temporary	MEWP
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.50	0.2	1007	28.0	21.0	10.0	1.0	29.8	0.848

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	3.4	32.4	33.6	34.2	33.4	6.2	15	3
	A2	12.5	35.4	34.1	33.2	34.2	6.3	15	3
	A3	37.5	33.2	31.6	32.8	32.5	6.1	15	3
	A4	46.7	34.6	33.8	32.5	33.6	6.2	15	5

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	6.2	1.0:1	15	288	4377	4124	4124
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Instrumental Gas Analyser Calibrations

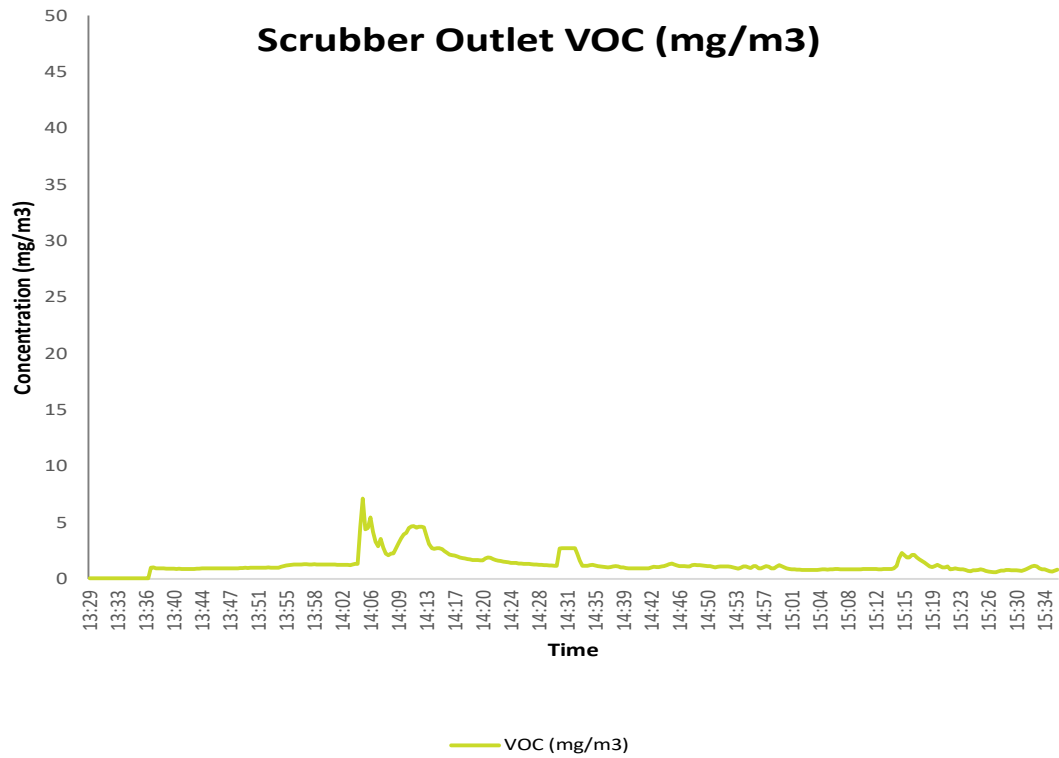
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
12/08/2024	LH JD	-	13.11

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Propane	81.54ppm	100ppm	35	81.6	0.00	81.3	0.20	81.0	0.25	-0.98	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Total VOC	1	1.32	7.15	0.08	mg/m ³	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



VOC Screen - Run 1

Sampling Details		
Collection Media	226-95	-
Sampling Rate	812	mL/min
Test Duration	60	min
Sample Volume	54.01	L
Corrected Sample Volume	48.71	NL
Temperature at Tube	30.0	°C

Date	Operators
12/08/2024	LH JD

Parameter	Value	Unit
Barometric Pressure	1007	mbar
Operating Temperature	31.0	°C
Time	13:30	14:30
		-

Species	1st Media Conc. (ug)	2nd Media Conc. (ug)	Collection Efficiency	Blank Media Conc. (ug)	Blank Conc. (mg/m3)	Emission (mg/m3)	Emission (as Carbon) (mg/m3)
Phenol	< 3	< 1	100%	< 1	< 0.02	< 0.08	-
Total Cresol	170	< 3	100%	< 3	< 0.06	3.55	-
Total			100%		< 0.08	3.63	-

Formaldehyde - Run 1 Calculations

Sampling Details		
Meter Box Number	8.03(B)	-
Gas Meter Coefficient	0.968	-
Pitot Coefficient	0.844	-
Stack Gas Molecular Weight	29.0	g/mole
Static Pressure in Stack	0.6	cmH ₂ O

Date	Operators
12/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1007	1007	mbar
Ambient Temperature	30.0	31.0	°C
Leak Check	0.00	0.00	L/min
Time	14:35	15:35	-

Analysis Details		
Collection Media	De-ionised Water	
1st Collector Reference	Imp ABC	
1st Collector Concentration	<2.954	µg
2nd Collector Reference	Imp D	
2nd Collector Concentration	<1.935	µg
Has breakthrough occurred?	No	-
Overall Blank Value (OBV)	< 0.011	mg/Nm ³
OBV <10% of ELV?	N/A	-

Emissions Calculations		
Total Sampling Time	60	min
Gas Meter Difference	307.0	L
Corrected Gas Meter Volume	297.2	L
Mean Sampling Rate	5.0	L/min
Gas Meter Volume (STP Dry)	0.279	Nm ³
Gas Meter Volume (REF)	0.281	Nm ³
Stack Gas Water Vapour Content	1.0	% v/v
Stack Gas Oxygen Content	N/A	% v/v
Emission Limit Value	N/A	mg/Nm ³
Concentration (REF)	< 0.0	mg/Nm ³
Mass Emissions (REF)	< 0	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Isokineticity Details		
Nozzle Diameter	-	mm
Average Gas Meter Temperature	16.5	°C
Average Stack Temperature	13	°C
Average Stack Velocity	-	m/s
Isokineticity	-	%

Uncertainty

Uncertainty of VOC Screen - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	N/A	mg/m ³
Mean Sampling Rate	0.8	L/min
Barometric Pressure	1007	mbar

Parameter	Value	Unit
Emission Concentration	3.63	mg/m ³
Monitoring Duration	60	min
Average Stack Temperature	17	°C

Source of Uncertainty	Uncertainty Criteria	Actual Source Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
Analysis	25% of result (95% confidence)	0.45	mg	12.5	0.45	0.21
Leak Rate	<2% of sampling rate	0.01	L/min	1.2	0.07	0.005
Time	1 minute	0.50	min	0.01	0.0005	0.000003
Sampling Flow Rate	2% of value	0.01	L/min	1.2	0.04	0.002
Temperature	1% of value	0.50	°C	0.17	0.006	0.00004
Pressure	1% of value	5.0	mbar	0.50	0.02	0.0003
Total						0.21
Combined Standard Uncertainty [(sum u²)^{0.5}]						0.46
Expanded Total Uncertainty as a % of emission conc. (95% confidence)						25.0
Expanded Total Uncertainty (mg/m³) (95% confidence)						0.91

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m ³
Reading	0.82	ppm
Span Gas Certified Value	81.5	ppm
Range	100	ppm

Cal Gas
C ₃ H ₈

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.20	Rectangular	1.73	-0.12	0.01
Span Drift (ppm)	0.30	Rectangular	1.73	0.17	0.03
Linearity (% of value)	0.82	Rectangular	1.73	0.004	0.00002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.003	0.000008
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.005	0.00002
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.13
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.36
Expanded Total Uncertainty (ppm) (95% confidence)					0.70
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					85
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.1
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					-

Uncertainty of Formaldehyde - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	N/A	mg/m³
Mean Sampling Rate	5.0	L/min
Leak Rate	0.00	L/min
Barometric Pressure	1007	mbar
Average Stack Temperature	13	°C
Sampled Stack Gas Volume	307	L

Parameter	Value	Unit
Mean Emission Concentration	0.02	mg/m³
Monitoring Duration	60	min
Console ID	8.03(B)	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	PD CEN/TS 17638		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	7.9	%	4.0	0.0007	0.0000005
Leak Rate	Rect	<2% of sampling rate	0.10	0.000	L/min	0.000	0.000	0.000
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.000005	0.0000000002
Gasmeter Volume	Std	<2% actual volume	6.1	1.1	L	0.37	0.00006	0.000000004
Temperature	Std	<1% absolute temperature	0.13	0.24	k	1.9	0.0003	0.0000001
Pressure	Std	<1% absolute pressure	10.1	1.0	mbar	0.10	0.00002	0.000000003
Total								0.0000006
Combined Standard Uncertainty [(sum u²) ^{0.5}]								0.0008
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								8.8
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.002

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	4377	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.04	-
Standard Uncertainty - Mean Velocity	0.11	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.22	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	3.5	%
Standard Uncertainty - Volumetric Flow Rate	101	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	199	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.

Report for the Periodic Monitoring of Emissions to Atmosphere

Permal Ltd

RP28 - V9 - Dust Filtration

Permit No: EPR 23/00006/A2
Installation: Gloucester
Monitoring Dates: 6th August 2024
Site Address: 270 Bristol Road, Gloucester, GL1 5TT

Report Number:	EM-00123	Version:	1	Visit:	2 in 2024
Date of Report:	6th September 2024				
Report Author:	Lee Heaton				
MCERTS No:	MM 17 1433	MCERTS Level:	2 (TE1, TE3, TE4)		

Approved By:	Rob Hester	Function:	Technical Support		
MCERTS No:	MM 06 766	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		

Signed:



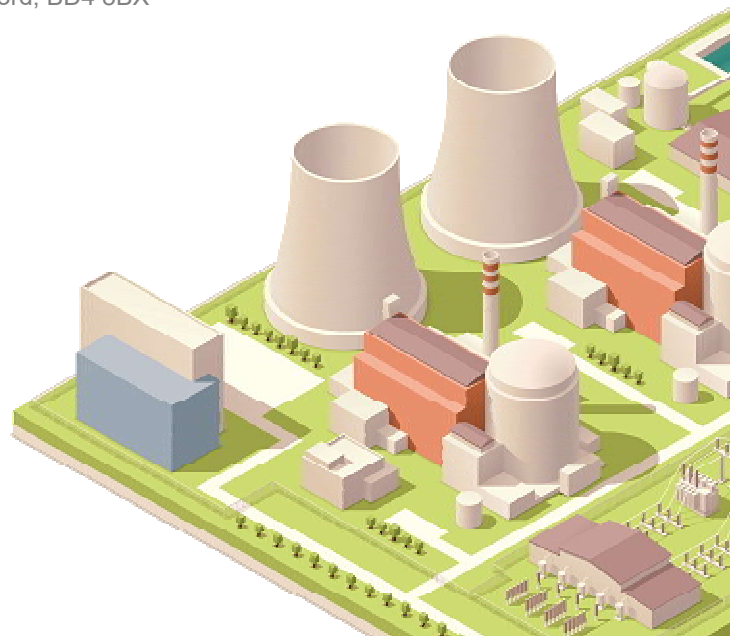
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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Permali Ltd to carry out emissions monitoring, to determine the compliance of RP28 - V9 - Dust Filtration with the conditions specified in the operators permit (EPR 23/00006/A2) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	RP28 - V9 - Dust Filtration
Total Particulate Matter	✓
Water Vapour	✓
Volumetric Flow	✓
	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Total Particulate Matter	R1	20	2.1	0.55	273k, 101.3kPa, Wet Gas	-	86.9	22.7	06/08/2024	12:22-12:54
Water Vapour	R1	-	0.90%	-	As Measured	-	-	-	-	-
Volumetric Flow (Actual)	R1	-	44,371 m³/h	2012	As Measured	-	-	-	06/08/2024	12:00 - 12:25
Volumetric Flow (REF)	R1	-	40,672 m³/h	1844	273k, 101.3kPa, Wet Gas	-	-	-	06/08/2024	12:00 - 12:25

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	V9 - RP28 - Dust Filtration
Continuous or Batch Process	Continuous Batch
Operating Status	Operational
Feedstock	N/A - Extraction
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	N/A
Plume Appearance	Non-Visible

Monitoring Deviations

Parameter	Run	Deviation
Total Particulate Matter	All	A single sampling lines was available, however, the number of sample points on the available line were increased to the minimum requirements of the standard.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr L Heaton	Team Leader	2 (TE1, TE3, TE4)	MM 17 1433
Mr J Durbin	Technician	Trainee	MM 24 1834

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522

Equipment Checklist

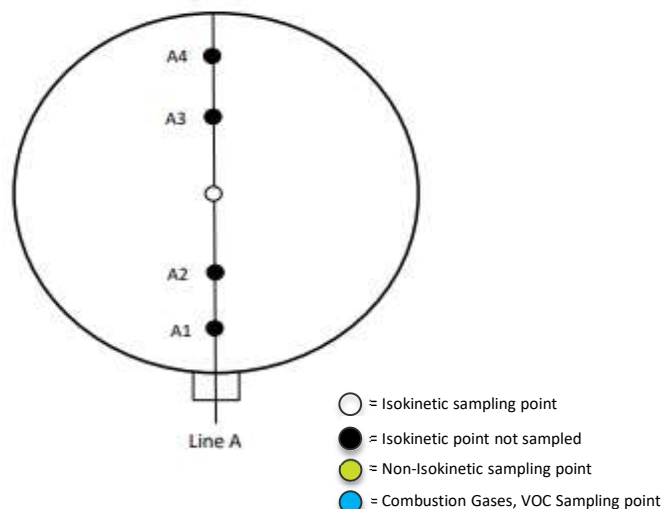
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.13	Horiba PG-250	-	Tape Measure	ETC17.09
Box Thermocouples	ETC-S2.13(a)	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S8.13	Horiba PG-350	-	Stopwatch	ETC-S10.13
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	ETC-S11.11
Control Box Timer	ETC-S8.13	MAK10 Cooler	-	Digital Manometer	ETC-S24.11(a)
Umbilical	ETC-S2.13b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.11
Oven Box	-	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.35	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S5.167	SK-Thermo FID	-	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	ETC-S5.29
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	ETC-S20.115	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.12	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.12	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.12	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.1	-	-	Laboratory Balance	-

Appendix 2: RP28 - V9 - Dust Filtration Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	1.00
Width	m	-
Area	m ²	0.8
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	1 / 2
Number of Sampling Points	4 / 4
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A

Platform Type and Location	
Platform Type - Permanent / Temporary	MEWP
Location - Inside / Outside	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	No

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
1.00	0.8	1000	20.0	21.0	10.0	0.9	30.3	0.844

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	6.7	208.3	218.4	209.6	212.1	15.6	21	6
	A2	25.0	210.7	212.5	213.4	212.2	15.6	21	6
	A3	75.0	213.4	215.8	219.3	216.2	15.7	21	7
	A4	93.3	215.6	217.8	220.3	217.9	15.8	21	8

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	15.7	1.0:1	21	294	44371	40672	40672
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.13	-
Gas Meter Coefficient	1.086	-
Pitot Coefficient	0.844	-
Stack Gas Molecular Weight	30.4	g/mole
Static Pressure in Stack	2.9	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	4.0	mm
Average Gas Meter Temperature	19.7	°C
Average Stack Temperature	23	°C
Average Stack Velocity	17.1	m/s
Isokineticity	105.5	%
Total Sampling Time	32	min
Gas Meter Difference	400	L
Corrected Gas Meter Volume	434	L
Mean Sampling Rate	13.6	L/min

Date	Operators
06/08/2024	LH JD

Parameter	Before	After	Unit
Barometric Pressure	1009	1009	mbar
Ambient Temperature	22.0	23.0	°C
Leak Check	0.00	-	L/min
Time	12:22	12:54	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.403	Nm ³
Gas Meter Volume (REF)	0.407	Nm ³
Stack Gas Water Vapour Content	0.9	% v/v
Stack Gas Oxygen Content	N/A	% v/v
TPM Concentration (REF)	2.1	mg/Nm ³
TPM Mass Emissions (REF)	87	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank 1	PR-47-6773	47mm GFA	0.20	0.35	0.55
1	PR-47-6648	47mm GFA	0.44	0.43	0.87

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1450.3	1265.7	1210.5	1430.5	2.9
	After	1452.3	1266.4	1210.1	1431.1	

Parameter	Value	Unit
Emission Limit Value (ELV)	20	mg/m ³
Overall Blank Value (OBV)	1.35	mg/m ³
OBV <10% of ELV?	Yes	-

Analysis Details	
Date of Analysis	19/08/2024
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit	Parameter	Value	Unit
Emission Limit Value (ELV)	20	mg/m³	Mean Emission Concentration	2.1	mg/m³
Mean Sampling Rate	13.6	L/min	Monitoring Duration	32	min
Leak Rate	0.00	L/min	Console ID	8.13	-
Barometric Pressure	1009	mbar	Temperature Uncertainty	0.24	°C
Average Stack Temperature	23	°C	Gas Meter Uncertainty	0.37	%
Sampled Stack Gas Volume	400	L	Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	1.0	0.28	mg	1.4	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.27	0.000	L/min	0.000	0.000	0.000
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0006	0.0000004
Gasmeter Volume	Std	<2%	8.0	1.5	L	0.37	0.01	0.0001
Temperature	Std	1% of value	0.23	0.24	°C	1.1	0.02	0.0005
Pressure	Std	1% of value	10.1	1.0	mbar	0.10	0.002	0.000004
Total								0.08
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								25.8
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								2.8

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	44371	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.030	-
Standard Uncertainty - Mean Velocity	0.21	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.41	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	2.6	%
Standard Uncertainty - Volumetric Flow Rate	1026	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	2012	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.