

Bellway Homes (North West) Ltd
2 Alderman Place
Liverpool
Merseyside
L24 9LR

Our Ref: 7791BEL211102L

BY EMAIL

2 November 2021

For the Attention of Mr A. Johnson

Dear Adrian,

Re: Ground Gas Monitoring Results for Land north of Gatewen Road, New Broughton, Wrexham.

Further to Coopers Site Investigation Report, referenced 7791si, revision B, Coopers have completed the proposed period of monitoring of hazardous ground gases on the above site. Please find enclosed a copy of the following:

- Coopers Ground Gas Monitoring Summary Table.
- External Calibration Certificates for GA5000 Ground Gas Monitor.

The completed monitoring was extended to ensure at least two of the 6 monitoring visits were undertaken during low atmospheric pressure conditions. The monitoring identified negligible concentrations and flow rates of hazardous ground gases, matching the initial findings reported within the Site Investigation Report.

We can therefore conclude that the monitoring supports the conceptual model and that no significant hazardous ground gases are present, although full radon precaution measures are required for all dwellings. The typical construction details and verification proposals for radon mitigation provided within the Site Investigation Report would therefore apply.

Should further information or details on the findings be required then please do not hesitate to contact this office.

Yours Sincerely



Ben Hill
BSc (Hons), CSci. MEnvSc, FGS
Senior Engineering Geologist

For COOPERS

Encs

Project Name: Gatewen Road, Wrexham
Project No. 7791
Prepared by: BH
Checked by: PRS

Date of Production: 2 August 2021

GROUND GAS MONITORING RECORD SUMMARY SHEET

Borehole Reference	Response Depth (m-bgl)	Date	Time	Temp (°c)	Gas Analyser	Weather Conditions	CH ₄ (peak) (%)	CH ₄ (steady) (%)	CO ₂ (peak) (%)	CO ₂ (steady) (%)	O ₂ (min.) (%)	O ₂ (steady) (%)	H ₂ S (peak) (ppm)	CO (peak) (ppm)	Flow (initial) (l/hr)	Flow (steady) (l/hr)	TWL (m - bgl)	Atmos. Pressure (mbar)	Remarks
WS01	1.0-4.0	03/06/2021	16:25:00	20	GA5000	Warm, broken cloud	0.1	0	1.7	1.7	18.1	18.1	0	1	0	0.3		1008	Dry
		14/06/2021	16:46:21	17	GA5000	Warm and dry	0.1	0.1	1.3	1.1	20.5	20.8	0	1	0.1	0.2	Dry	1013	
		15/07/2021	N/A	18	GA5000	Cloudy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Borehole vandalised, cover opened and bung missing, replaced for monitoring on subsequent visit
		06/08/2021	10:03:38	17	GA5000	Rain	0.1	0.1	0.2	0.2	21.3	21.3	0	1	0.1	0.2	Dry	984	
		13/09/2021	16:46:24	17	GA5000	Cloudy, dry	0.3	0.3	1.8	1.8	19.8	19.8	0	0	0.2	0.3	Dry	1006	
		01/11/2021	09:24:34	9	GA5000	Heavy Rain	0.1	0.1	0.7	0.6	21.1	21.2	0	0	0.2	0.3	Dry	978	
WS02	1.0-4.0	03/06/2021	16:40:00	20	GA5000	Warm, broken cloud	0	0	3.4	3.2	14.2	14.3	1	3	0	0.2	Dry	1009	Dry
		14/06/2021	17:02:52	17	GA5000	Warm and dry	0.1	0	3.4	3.3	16.3	16.3	0	1	0	0.2	Dry	1013	
		15/07/2021	08:57:00	18	GA5000	Cloudy	0.1	0.1	3.6	3.5	16.9	16.9	0	1	0.1	0.3	Dry	1014	
		06/08/2021	09:19:18	17	GA5000	Rain	0.2	0.2	3.6	3.5	17.5	17.5	0	0	0	0.1	Dry	984	
		13/09/2021	17:01:06	17	GA5000	Cloudy, dry	0.3	0.3	2.8	2.7	19.1	19.2	0	0	0.2	0.3	Dry	1006	
		01/11/2021	09:39:56	9	GA5000	Heavy Rain	0.1	0	2.6	2.5	19.5	19.6	0	0	0.1	0.2	Dry	979	
WS03	1.0-4.0	03/06/2021	16:55:00	20	GA5000	Warm, broken cloud	0	0	4.7	4.6	15.8	16	0	3	0	0.1	Dry	1001	Dry
		14/06/2021	17:17:27	17	GA5000	Warm and dry	0.1	0.1	2.9	2.8	19.4	19.5	0	1	0	0.2	Dry	1012	
		15/07/2021	09:13:00	18	GA5000	Cloudy	0.1	0.1	3.4	3.3	18.3	18.4	0	1	0	0.2	Dry	1014	
		06/08/2021	09:34:46	17	GA5000	Rain	0.1	0.1	2.4	2.3	19.6	19.8	0	0	0.2	0.3	Dry	983	
		13/09/2021	17:14:18	17	GA5000	Cloudy, dry	0.3	0.3	2.5	2.5	20.1	20.2	0	0	0	0.2	Dry	1006	
		01/11/2021	09:51:58	9	GA5000	Heavy Rain	0.1	0	1.9	1.8	20.7	20.8	0	0	0.3	0.6	Dry	978	
WS04	1.0-3.75	03/06/2021	17:12:00	20	GA5000	Warm, broken cloud	0	0	1.6	1.5	20	20.2	0	2	0	0.1	Dry	1009	Damp at base
		14/06/2021	17:31:27	17	GA5000	Warm and dry	0.1	0.1	0.8	0.8	21.5	21.6	0	1	0	0.1	Dry	1013	
		15/07/2021	09:30:00	18	GA5000	Cloudy	0.1	0.1	2.2	2	19.5	19.9	0	1	0	0.1	Dry	1015	
		06/08/2021	09:49:16	17	GA5000	Rain	0.1	0.1	1.7	1.6	20	20.1	0	0	0.1	0.2	Dry	983	
		13/09/2021	N/A	17	GA5000	Cloudy, dry	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Borehole not monitored on this visit, unable to locate due to long grass and getting dark.
		01/11/2021	11:00:04	9	GA5000	Heavy Rain	0	0	1.1	1.1	20.5	20.6	0	0	0	0	Dry	979	
WS05	1.0-4.0	03/06/2021	17:30:00	20	GA5000	Warm, broken cloud	0	0	4.8	4.6	13.5	13.5	0	2	0.1	0.2	1.80	1008	
		14/06/2021	17:45:24	17	GA5000	Warm and dry	0.1	0	5.1	5	18.3	18.3	0	1	0	0.2	1.74	1012	
		15/07/2021	09:46:00	18	GA5000	Cloudy	0.1	0.1	5	4.8	15.8	15.8	0	1	0	0.1	2.94	1014	
		06/08/2021	10:19:56	17	GA5000	Rain	0.1	0.1	4.7	4.5	18	18.2	0	1	0	0.1	3	983	
		13/09/2021	18:05:52	17	GA5000	Cloudy, dry	0.2	0.2	3.5	3.4	19.5	19.6	0	1	0	0.2	3.2	1005	
		01/11/2021	10:40:44	9	GA5000	Heavy Rain	0	0	3.1	3	18.6	18.7	0	0	0	0.2	2.1	978	

Visit Conditions Summary

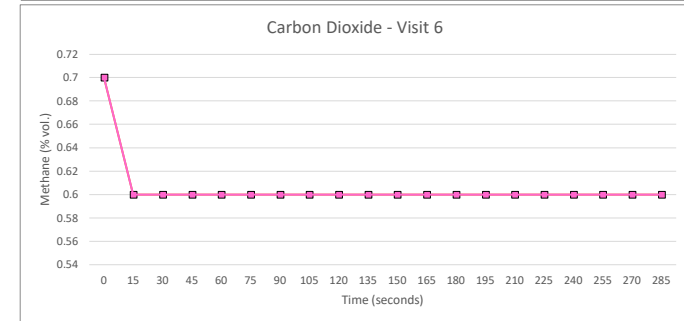
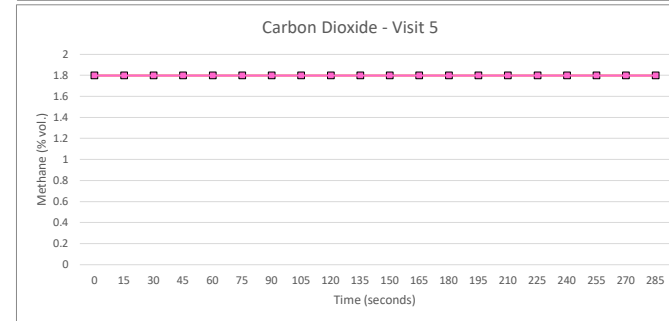
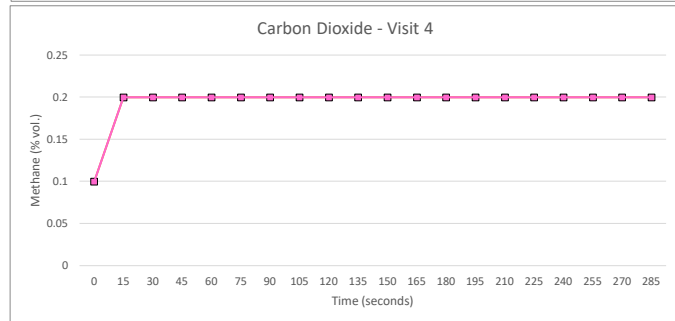
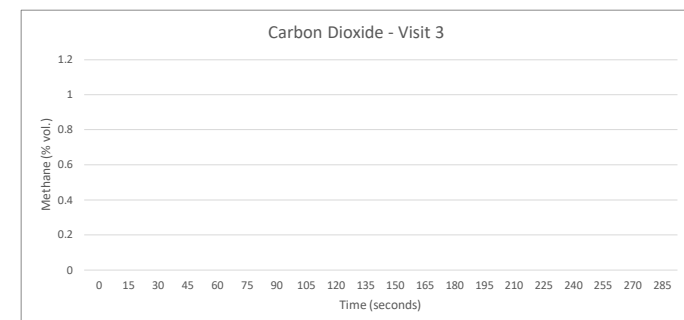
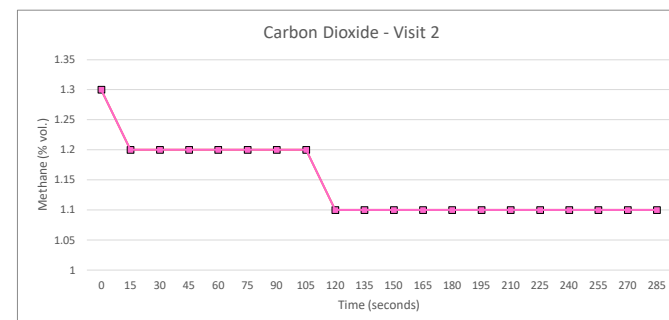
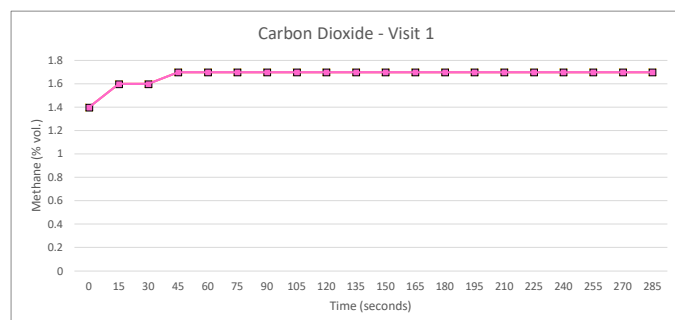
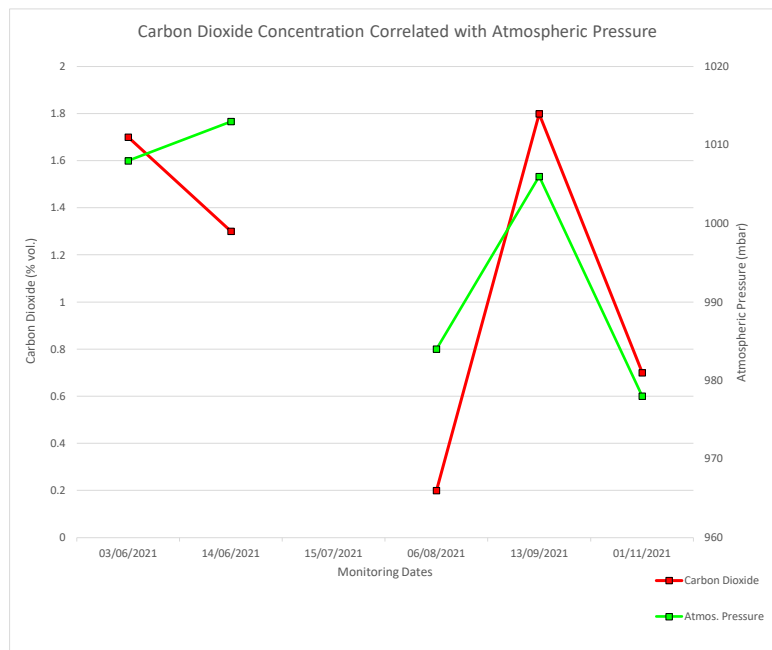
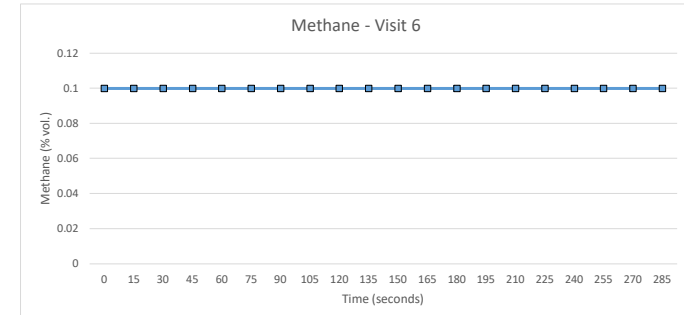
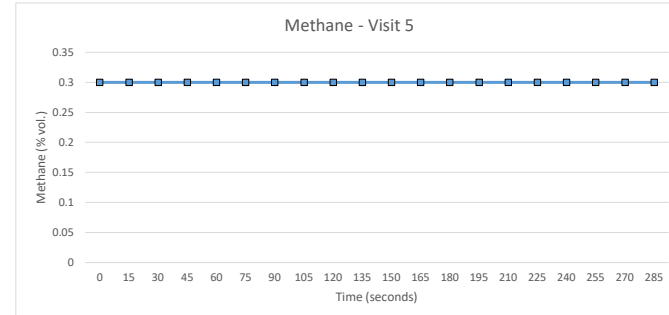
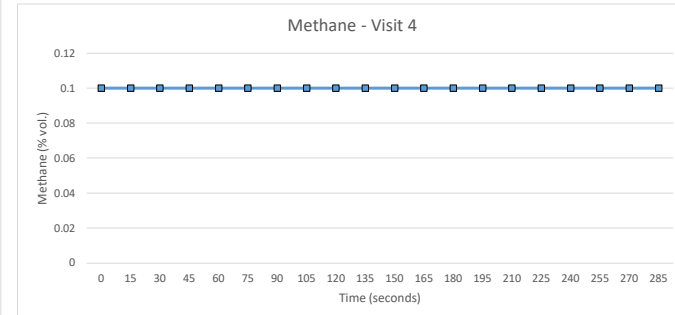
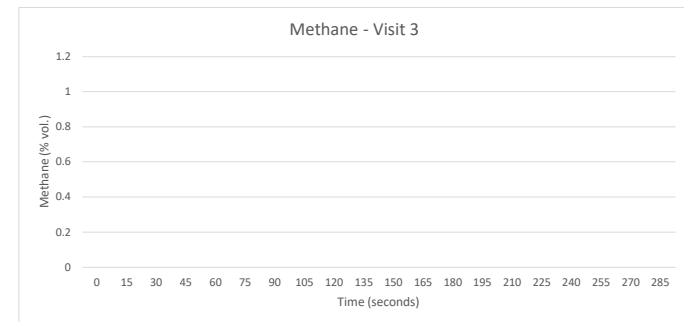
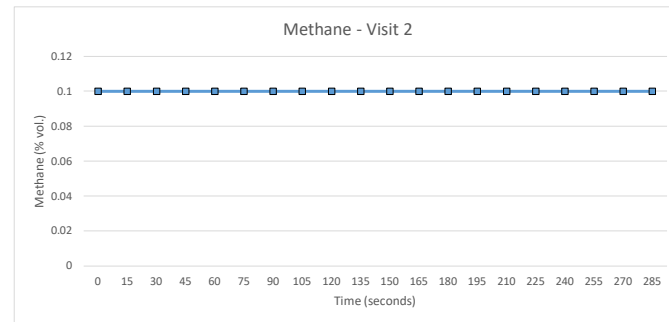
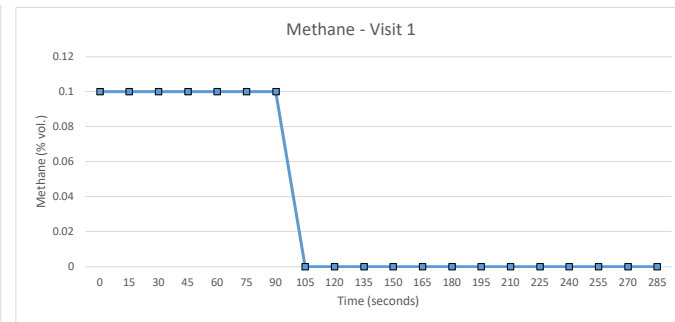
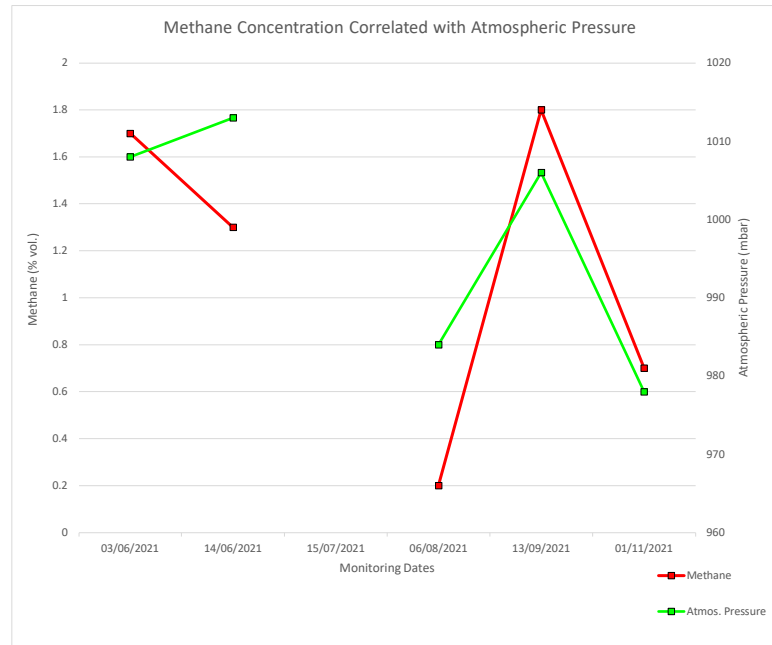
Visit Date	Temperature	Atmos Pressure	Pressure Trend	Weather
03/06/2021	20	1008	Steady	Warm, broken cloud
14/06/2021	17	1013	Steady/Falling	Warm and dry
15/07/2021	18	1014	Steady	Cloudy
06/08/2021	17	984	Steady	Rain
13/09/2021	17	1006	Steady	Cloudy, dry
01/11/2021	9	978	Rising	Heavy Rain

Borehole Summary Data

Borehole:	WS01
Visits:	6
Peak CH ₄ :	0.3
Peak CO ₂ :	1.8
Min O ₂ :	18.1
Peak Flow:	0.3

Borehole Risk Classifications

CH ₄ GSV:	0.0009
CO ₂ GSV:	0.0054
NHBC GSV Class:	Green
BS8485 GSV Class:	CS1
BS8576 flow change:	3.89
BS8576 % change:	23.33

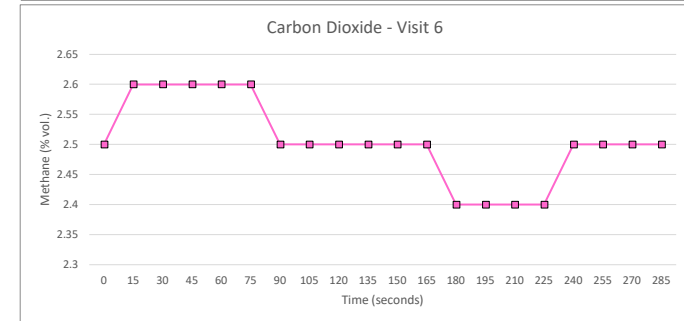
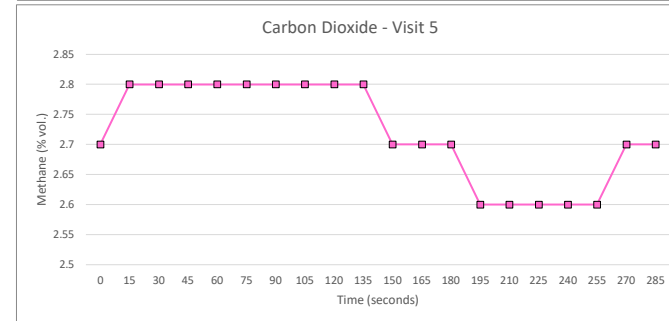
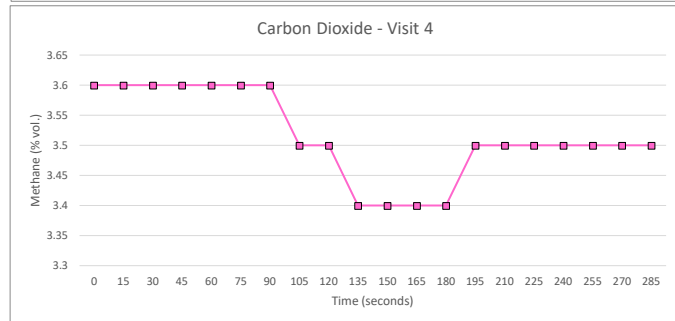
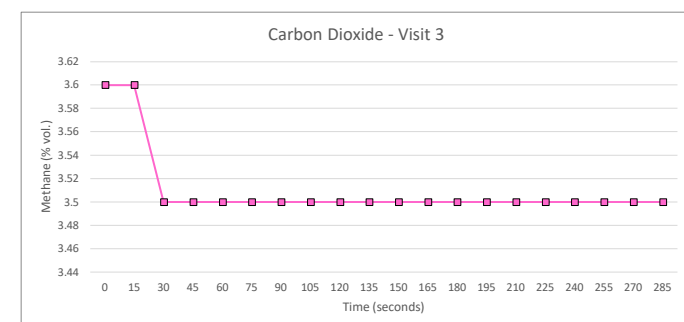
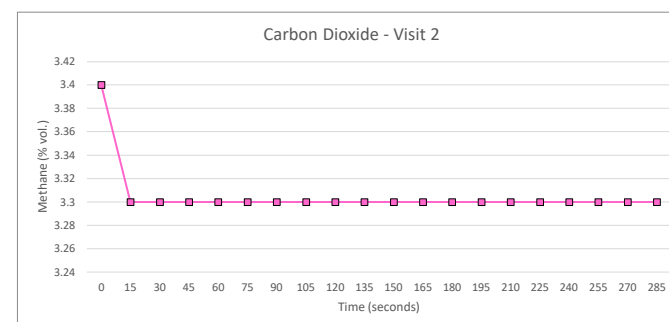
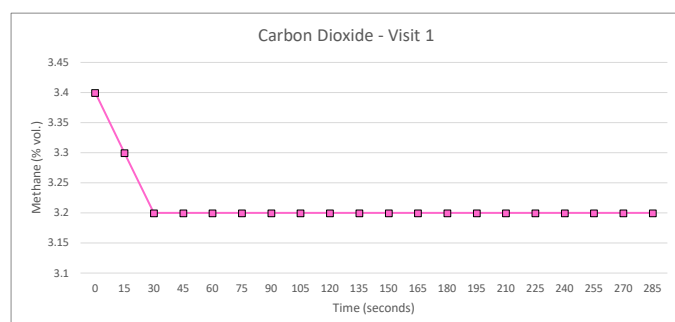
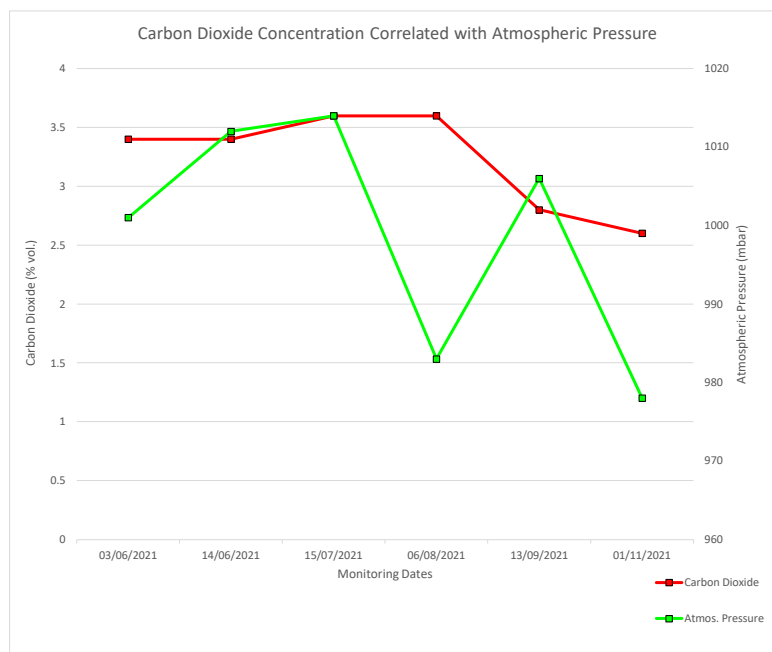
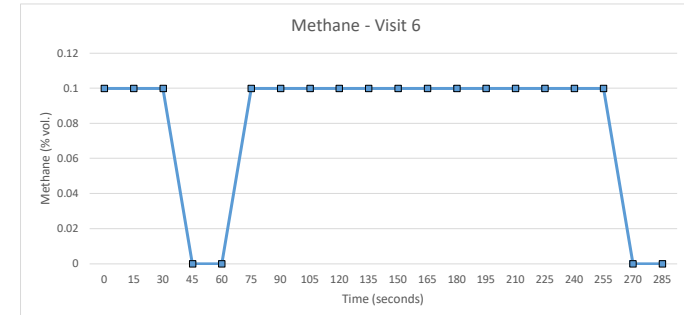
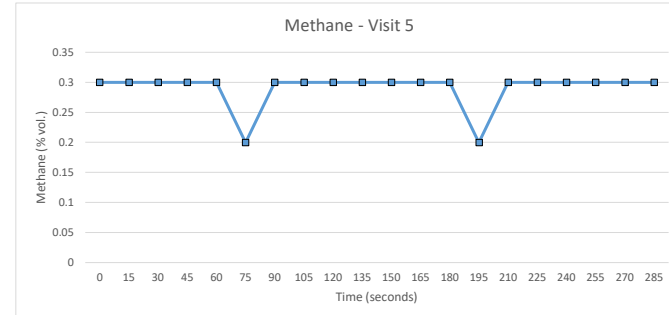
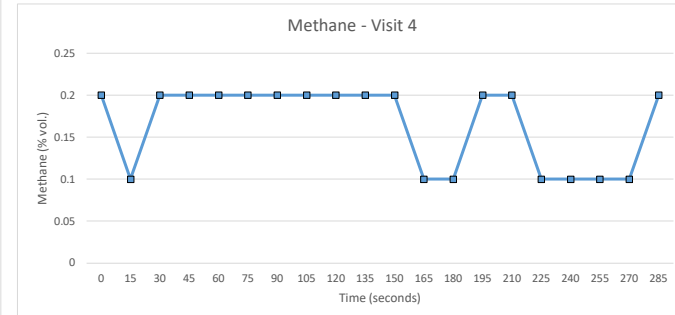
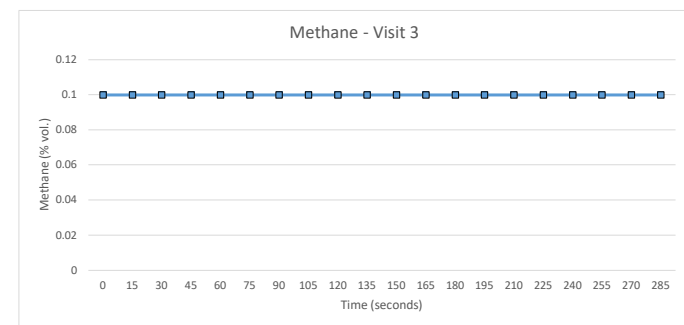
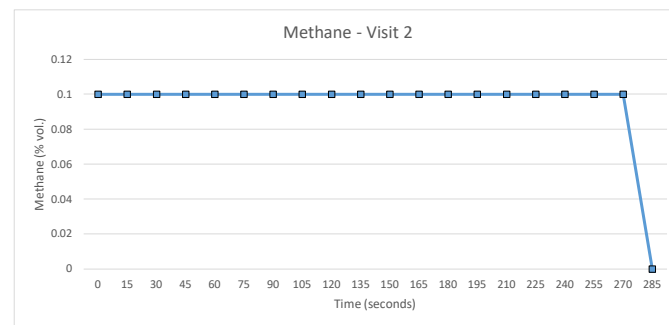
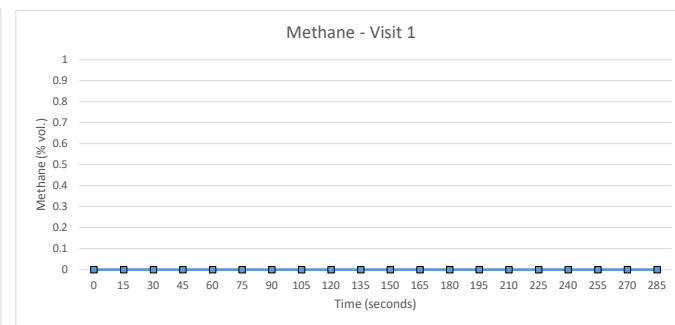
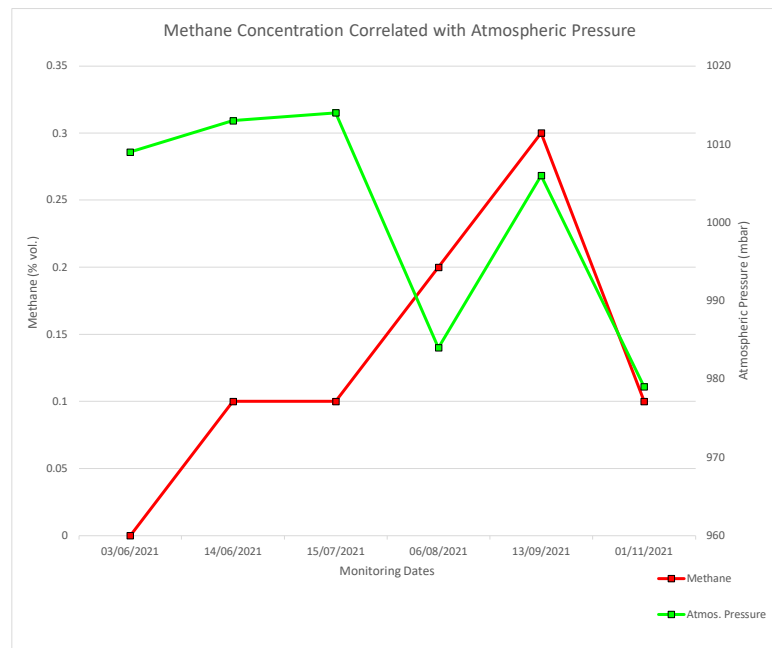


Borehole Summary Data

Borehole:	WS02
Visits:	6
Peak CH₄:	0.3
Peak CO₂:	3.6
Min O₂:	14.2
Peak Flow:	0.3

Borehole Risk Classifications

CH₄ GSV:	0.0009
CO₂ GSV:	0.0108
NHBC GSV Class:	Green
BS8485 GSV Class:	CS1
BS8576 flow change:	1.94
BS8576 % change:	23.33

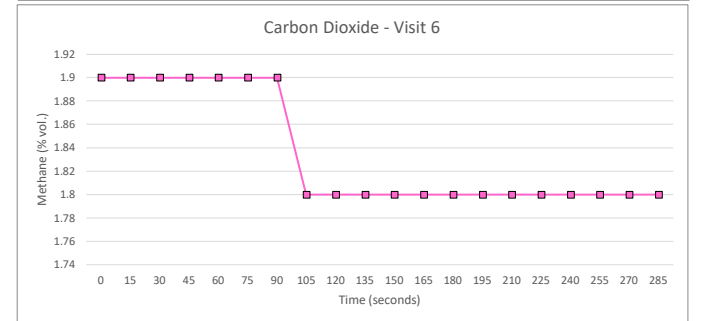
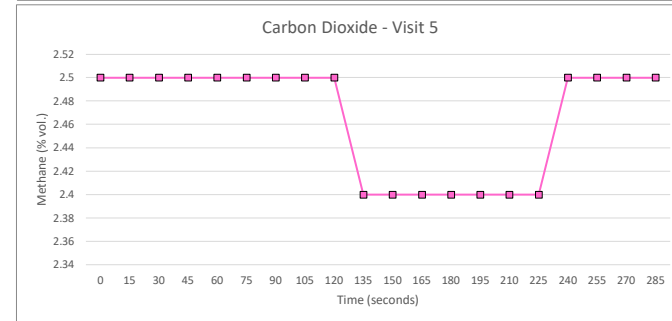
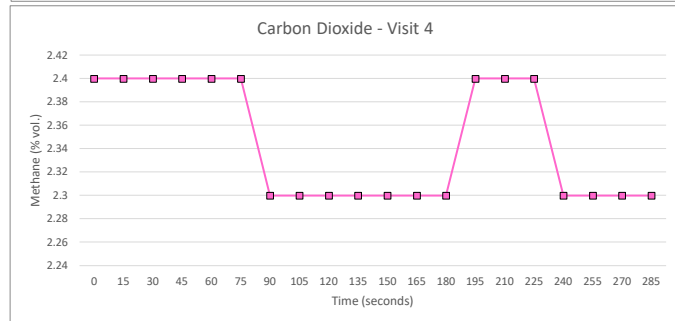
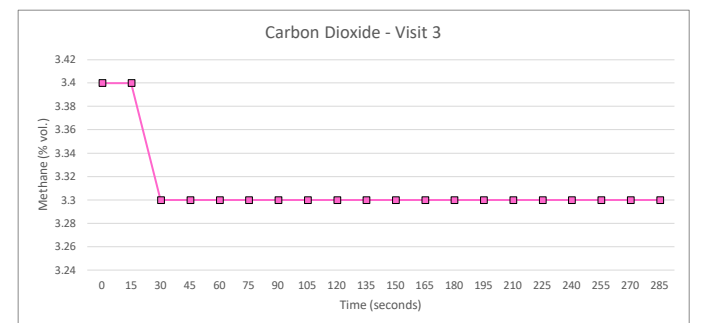
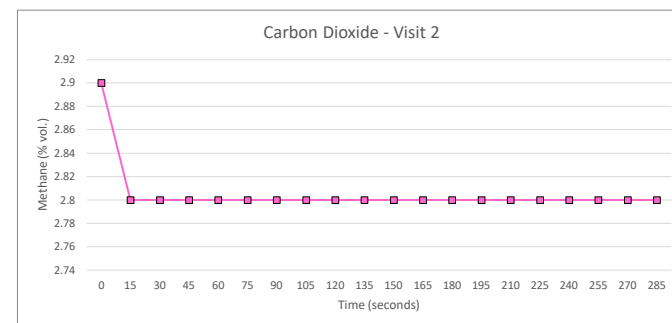
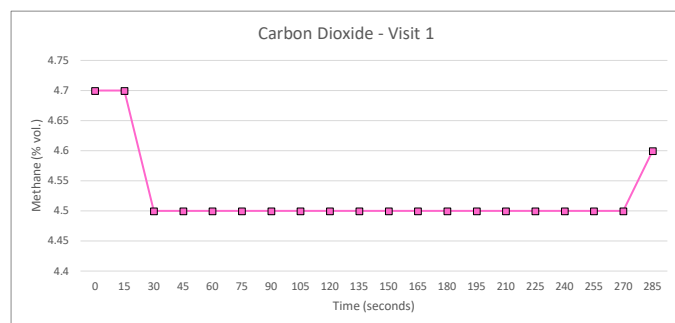
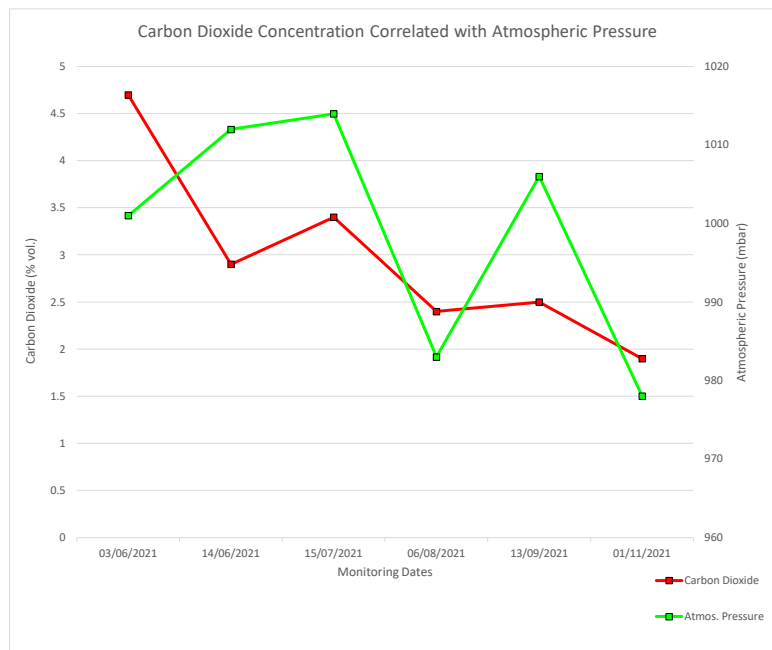
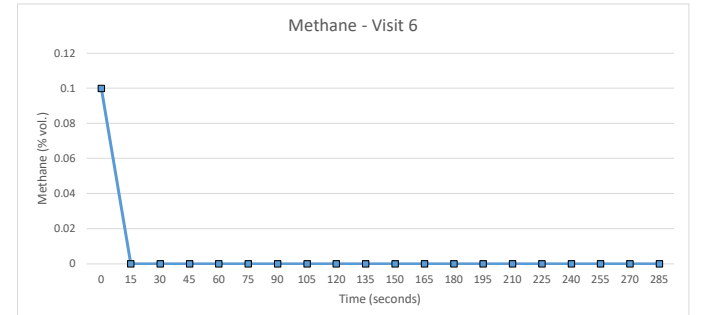
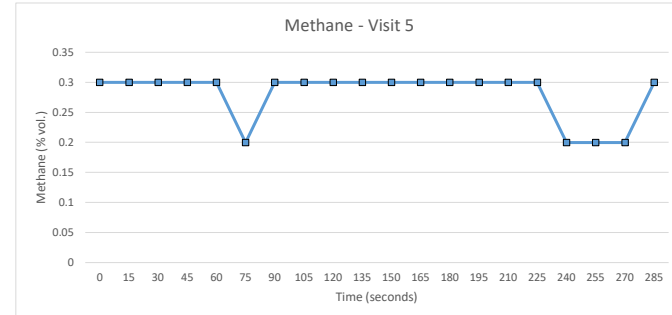
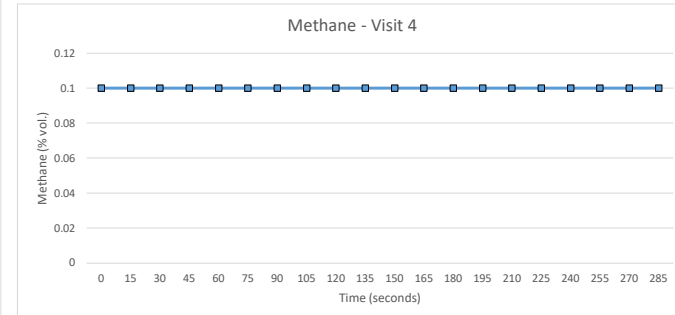
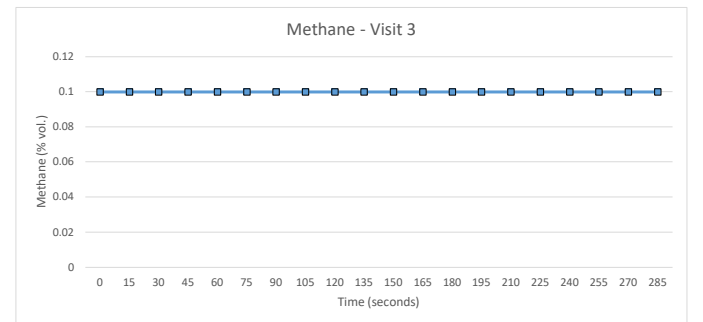
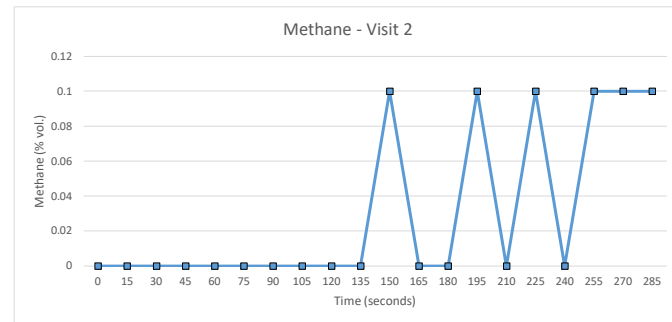
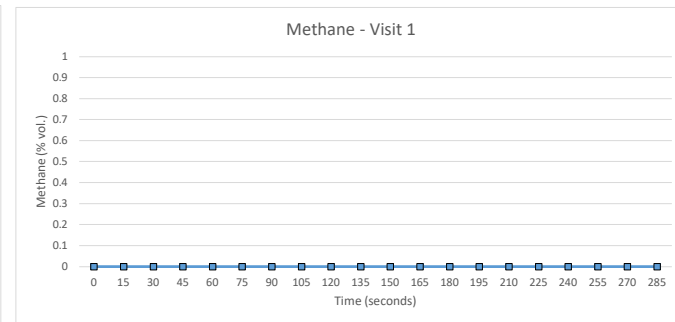
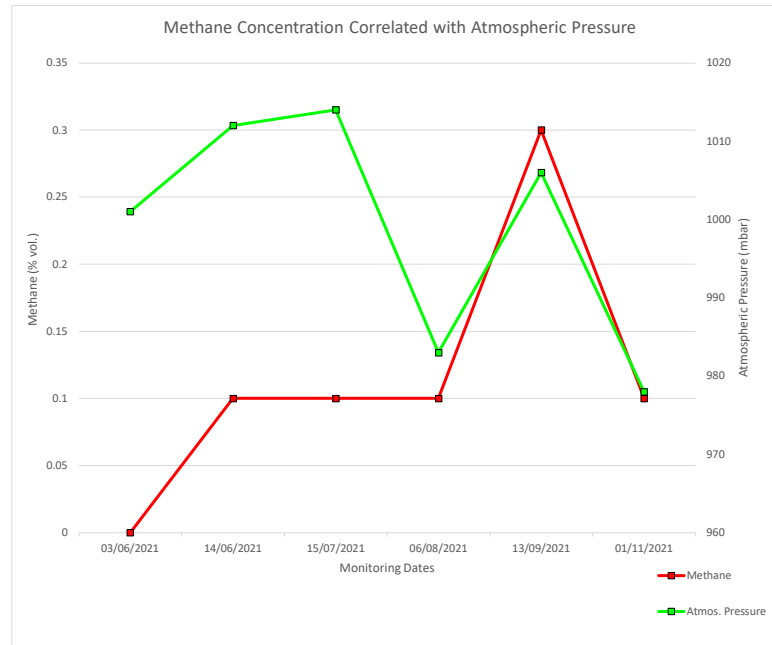


Borehole Summary Data

Borehole:	WS03
Visits:	6
Peak CH₄:	0.1
Peak CO₂:	4.7
Min O₂:	15.8
Peak Flow:	0.6

Borehole Risk Classifications

CH₄ GSV:	0.0006
CO₂ GSV:	0.0282
NHBC GSV Class:	Green
BS8485 GSV Class:	CS1
BS8576 flow change:	1.49
BS8576 % change:	11.67

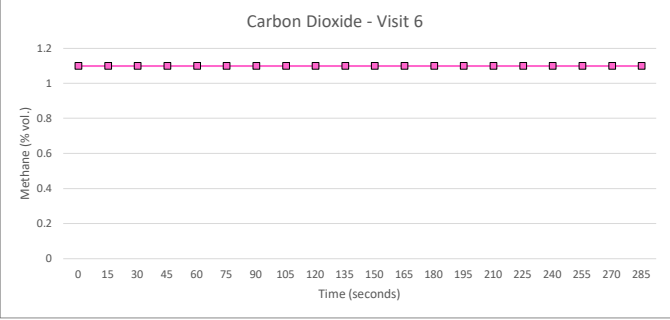
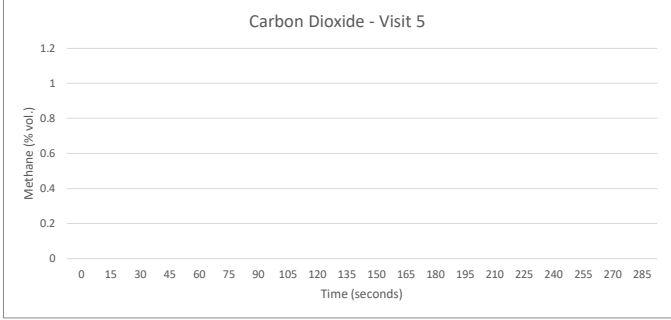
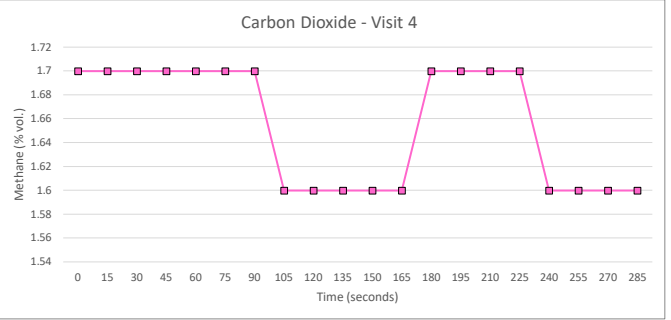
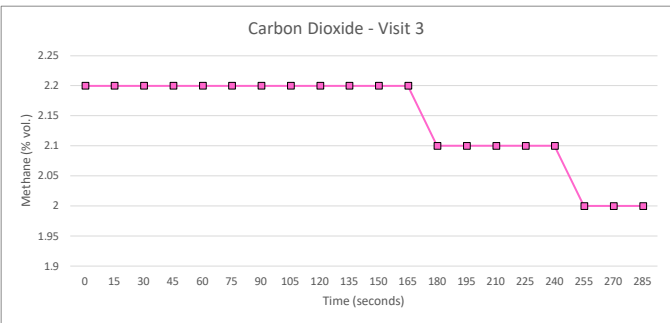
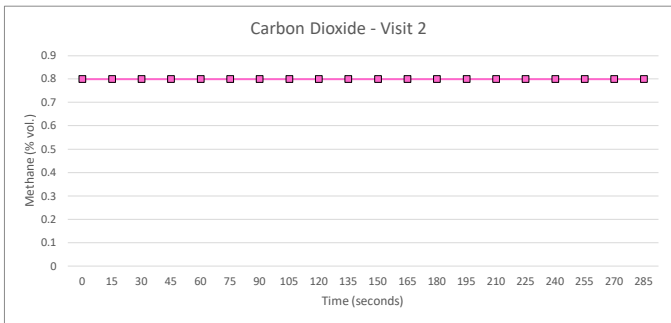
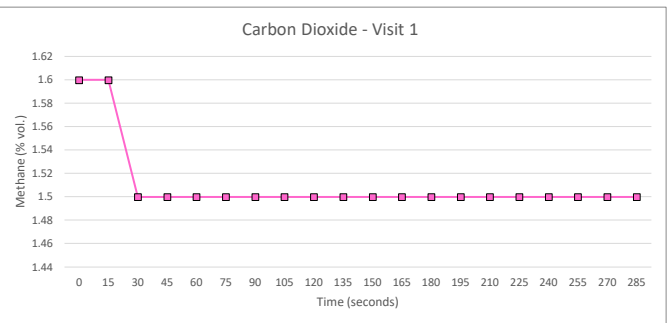
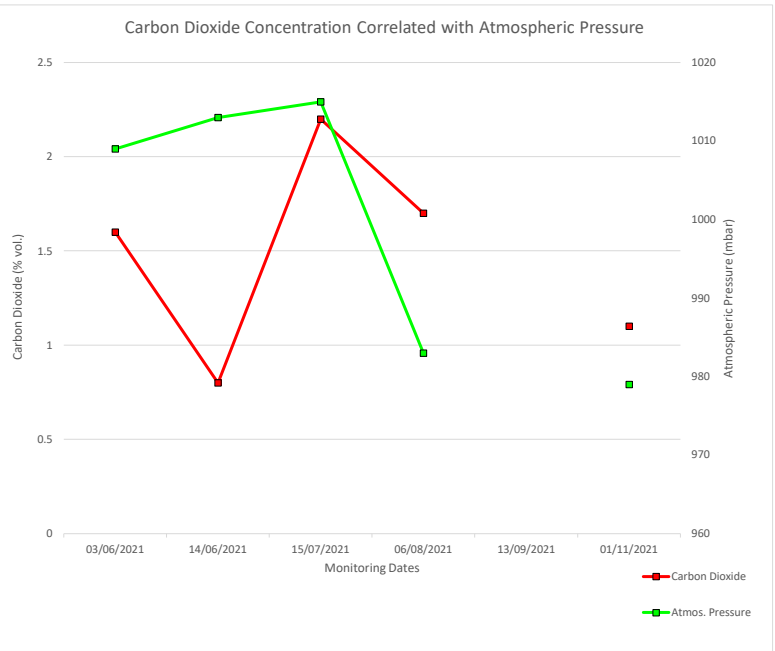
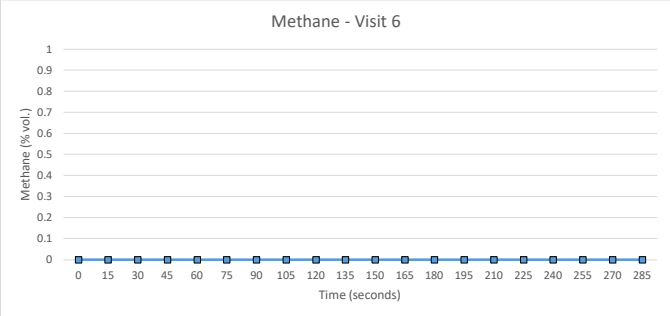
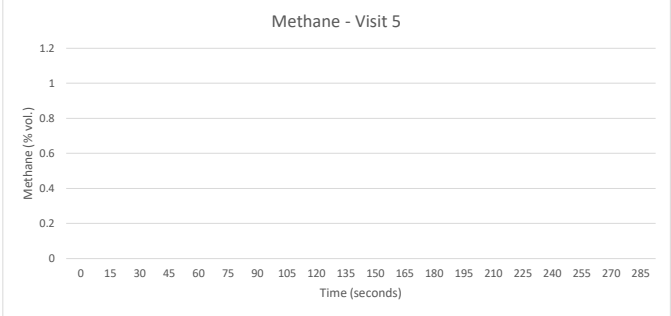
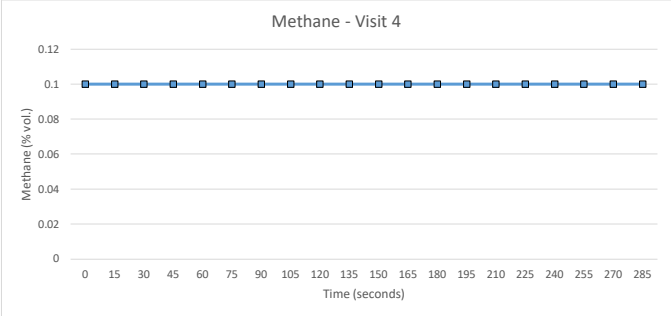
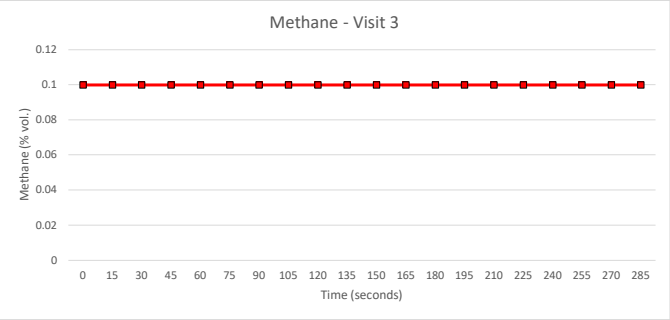
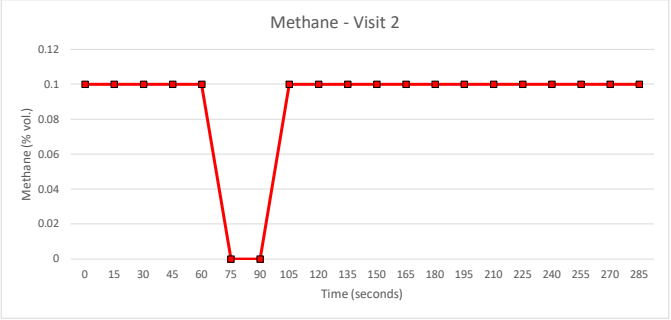
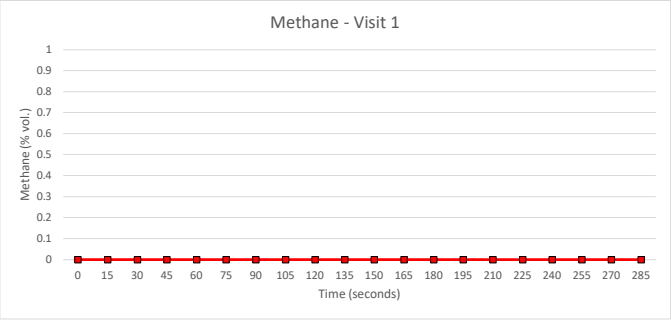
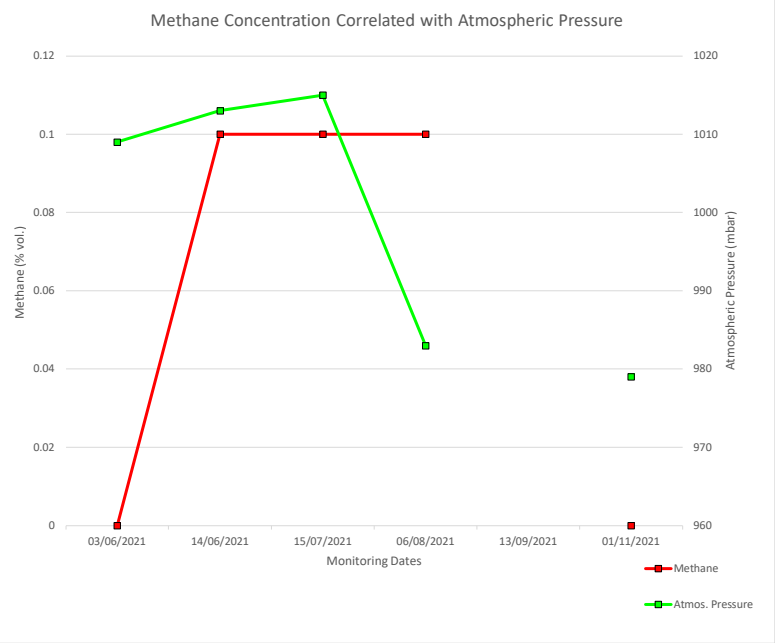


Borehole Summary Data

Borehole:	WS04
Visits:	6
Peak CH ₄ :	0.1
Peak CO ₂ :	2.2
Min O ₂ :	19.5
Peak Flow:	0.2

Borehole Risk Classifications

CH ₄ GSV:	0.0002
CO ₂ GSV:	0.0044
NHBC GSV Class:	Green
BS8485 GSV Class:	CS1
BS8576 flow change:	3.18
BS8576 % change:	35.00

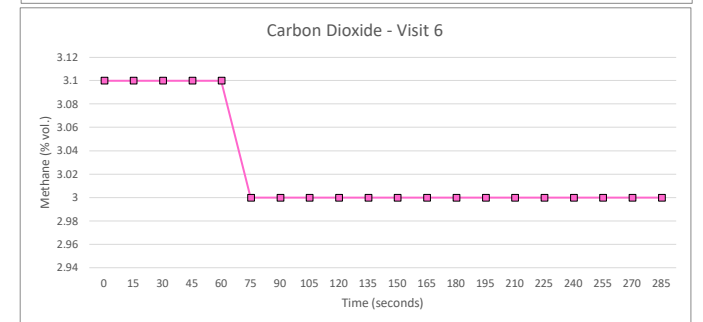
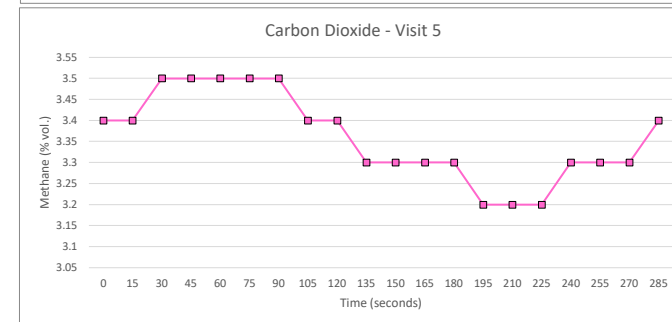
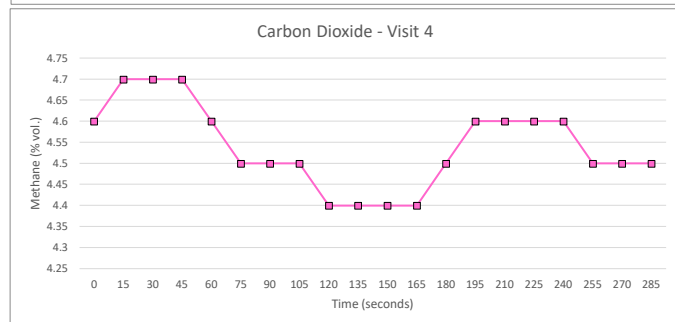
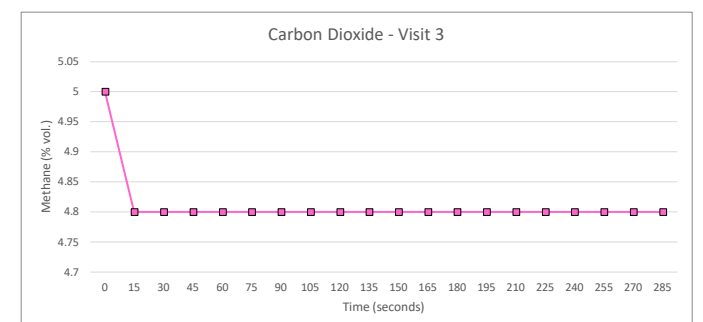
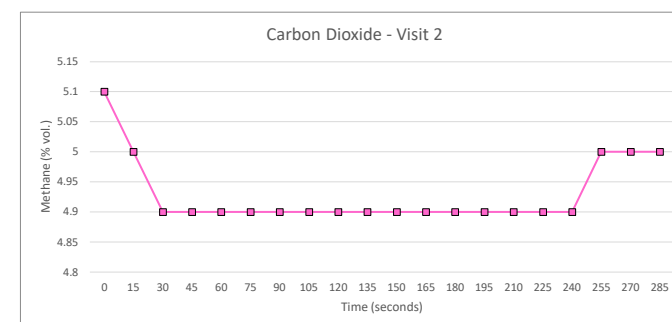
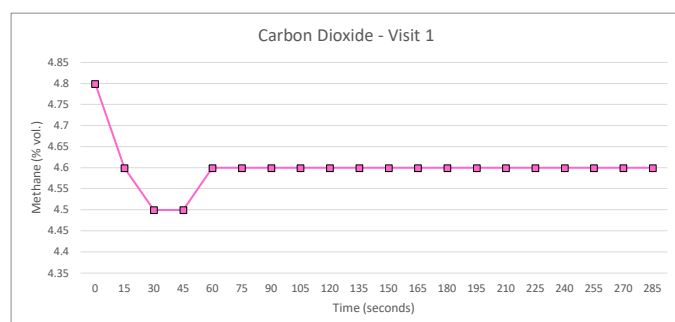
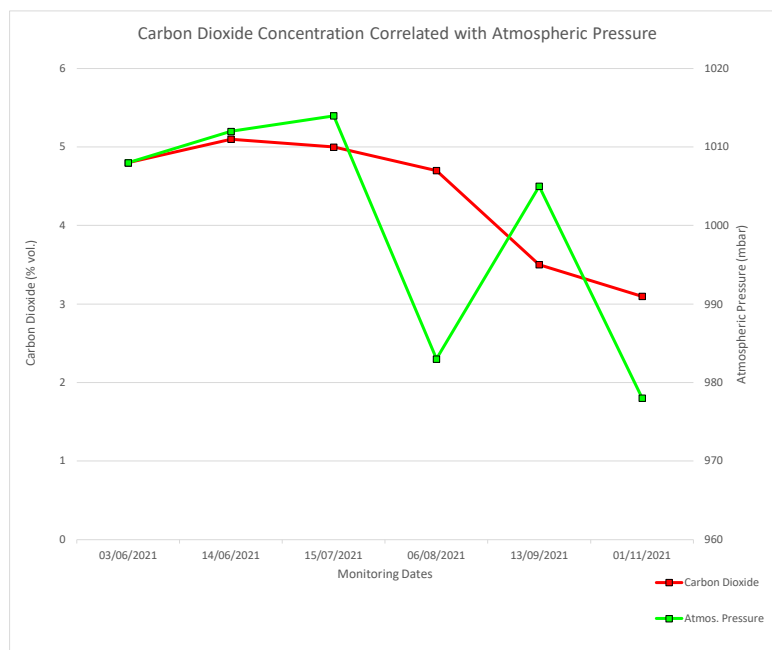
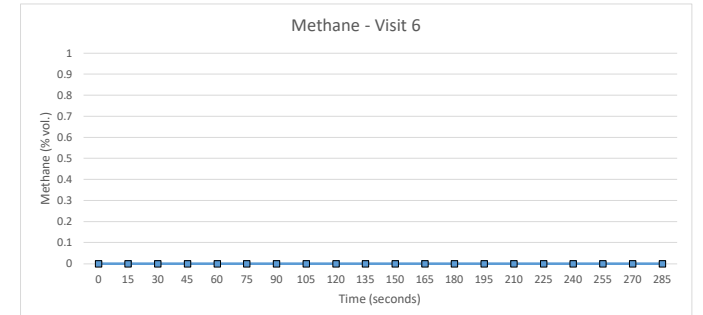
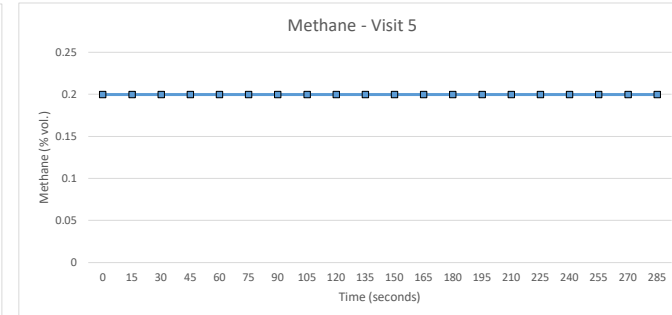
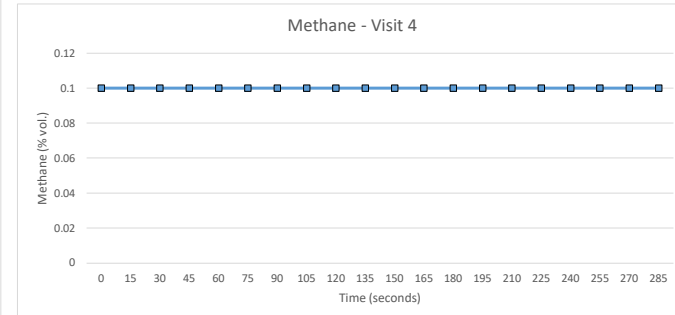
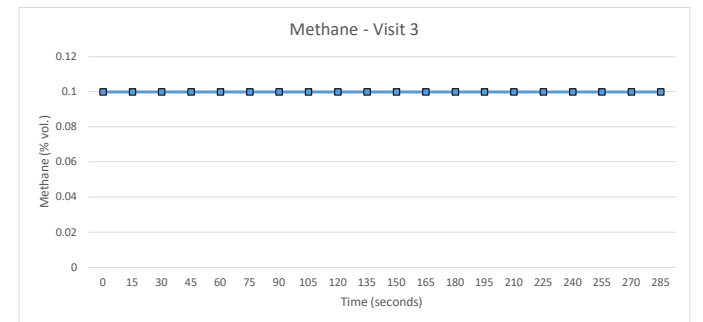
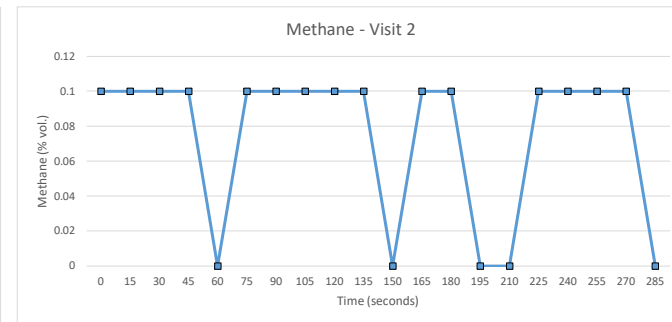
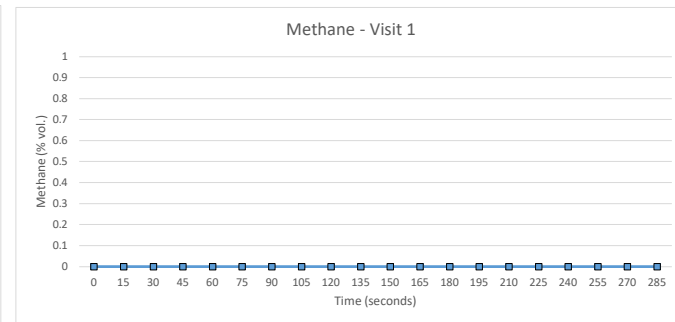
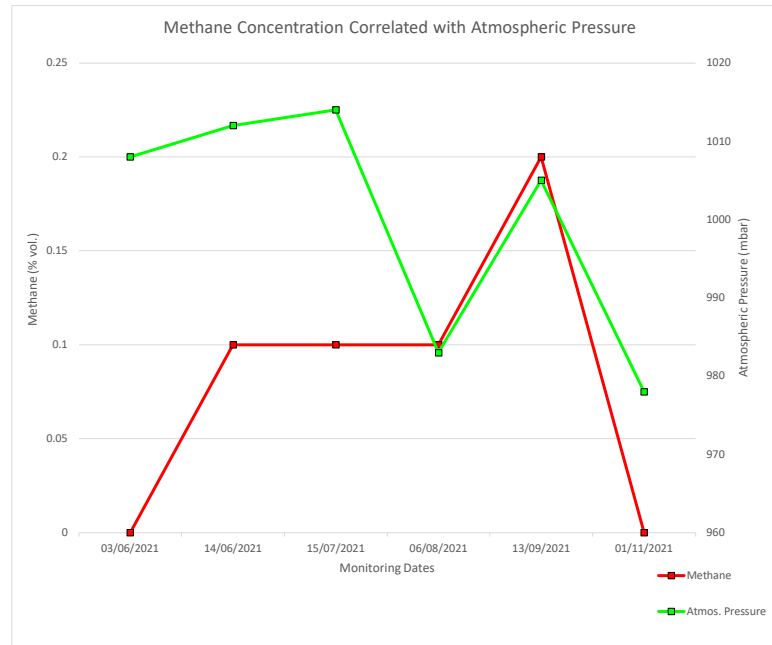


Borehole Summary Data

Borehole:	WS05
Visits:	6
Peak CH₄:	0.2
Peak CO₂:	5.1
Min O₂:	13.5
Peak Flow:	0.2

Borehole Risk Classifications

CH₄ GSV:	0.0004
CO₂ GSV:	0.0102
NHBC GSV Class:	Green
BS8485 GSV Class:	CS1
BS8576 flow change:	1.37
BS8576 % change:	35.00



CERTIFICATION OF CALIBRATION



Date Of Calibration: 23-Mar-2021

Certificate Number: G501314_2/27736

Issued by: QED Environmental Systems Ltd.

Customer: Coopers
Park House Sandpiper Court Chester Business Park
CHESTER CH4 9QU UNITED KINGDOM

Description: Gas Analyser

Model: GA5000

Serial Number: G501314

UKAS Accredited results:

Results after adjustment :

Methane (CH ₄)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	4.9	0.072
15.0	15.0	0.13
60.0	59.8	0.42

Carbon Dioxide (CO ₂)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	5.0	0.074
15.0	15.0	0.13
40.0	40.2	0.29

Oxygen (O ₂)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
21.4	21.5	0.25

The inwards assessment was carried out 16-Mar-2021.

The maximum adjustment is larger than the specification limit.

Inwards assessment data is available if requested.

All concentrations are molar.

CH₄, CO₂ readings recorded at : 32.8 °C ± 2.5 °C

O₂ readings recorded at : 24.3 °C ± 2.5 °C

Barometric Pressure : 1013 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Instrument has passed calibration as the measurement result is within the specification limit. The specification limit takes into account the measurement uncertainty.

The results relate only to the item calibrated

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance:111 IGC Instance:111

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QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

CERTIFICATION OF CALIBRATION



Date Of Calibration: 23-Mar-2021

Certificate Number: G501314_2/27736

Issued by: QED Environmental Systems Ltd.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

Non-UKAS accredited results after adjustment:

Barometer (mbar)	
Reference	Instrument Reading
1013	1013

Additional Gas Cells		
Gas	Certified Gas (ppm)	Instrument Reading (ppm)
CO	486	486
H ₂ S	250	250

Internal Flow	
Applied (l/hr)	Instrument Reading (l/hr)
5.0	5.1
10.0	10.0

Date of Issue : 29-Mar-2021

Approved by Signatory

Dawn Hemings

Laboratory Inspection

End of Certificate

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance:111 IGC Instance:111

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QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

CERTIFICATION OF CALIBRATION



Date Of Calibration: 19-Oct-2021

Certificate Number: G501314_2/29066

Issued by: QED Environmental Systems Ltd.

Customer: Coopers
Park House Sandpiper Court Chester Business Park
CHESTER CH4 9QU UNITED KINGDOM

Description: Gas Analyser

Model: GA5000

Serial Number: G501314

UKAS Accredited results:

Results after adjustment :

Methane (CH ₄)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	4.9	0.072
14.9	14.8	0.13
59.7	59.5	0.42

Carbon Dioxide (CO ₂)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	5.0	0.074
15.1	15.1	0.13
40.3	40.4	0.29

Oxygen (O ₂)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
21.2	21.2	0.25

The inwards assessment was carried out 06-Oct-2021.

The maximum adjustment is larger than the specification limit.

Inwards assessment data is available if requested.

All concentrations are molar.

CH₄, CO₂ readings recorded at : 32.6 °C ± 2.5 °C

O₂ readings recorded at : 22.9 °C ± 2.5 °C

Barometric Pressure : 0999 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Instrument has passed calibration as the measurement result is within the specification limit. The specification limit takes into account the measurement uncertainty.

The results relate only to the item calibrated

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance:112 IGC Instance:112

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QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

CERTIFICATION OF CALIBRATION



Date Of Calibration: 19-Oct-2021

Certificate Number: G501314_2/29066

Issued by: QED Environmental Systems Ltd.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

Non-UKAS accredited results after adjustment:

Barometer (mbar)	
Reference	Instrument Reading
999	999

Additional Gas Cells		
Gas	Certified Gas (ppm)	Instrument Reading (ppm)
CO	509	509
H ₂ S	259	259

Internal Flow	
Applied (l/hr)	Instrument Reading (l/hr)
5.00	5.00
10.00	9.90

Date of Issue : 20-Oct-2021

Approved by Signatory

Laura McBride

Laboratory Inspection

End of Certificate

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Calibration Instance:112 IGC Instance:112

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