Environmental
Geotechnical
Specialists

GAS MONITORING

job number	date
C1803/22/E/4045	May 2022

site address
Stanley Mills
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GEOTECHNICAL ENVIRONMENTAL

Our Ref C1803/22/E/4045.rev1
5th May 2022

Environmental Geotechnical Specialists

RGS

Stanley Mills (Milnsbridge) Limited,
19-25 Peckover Street,
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BD1 5BD

For the attention of Michael Chow

Dear Michael,

Ref: Stanley Mills, Huddersfield, HD3 4QS

Further to our report on a geo-environmental investigation (C1803/21/E/2788) which was presented in July 2021, we have now completed the gas monitoring and present our findings.

Monitoring

Gas monitoring standpipes were installed to between 1.5m and 4.0m depth in boreholes WS01, WS03 and WS04, the locations of which are provided on the site plan presented as Appendix 1 of the geo-environmental report. The first four gas monitoring visits were made to the site between the 2nd July and the 23rd July 2021. A further two visits were made on 19th March and 5th May 2022. The results of this work are tabulated below:

Table 1: Gas monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS01	02.07.21	**0.1**	**0.2**	**20.2**	**0.0**	**1004**→	-	1.5
	09.07.21	**0.1**	**0.2**	20.7	**0.0**	1008↑	-	
	16.07.21	**0.1**	**0.3**	20.5	**0.0**	**1016**→	-	
	23.07.21	**0.1**	**0.3**	**20.8**	**0.0**	1005→	-	
	19.04.22	**0.1**	**0.1**	**21.1**	0.0	**1007**↑	-	
	05.05.22	**0.1**	**0.1**	**21.1**	0.0	1012↑	-	
WS03	02.07.21	**0.0**	3.1	18.9	**0.1**	**1004**→	-	4.0
	09.07.21	**0.0**	2.5	18.7	**0.1**	1009↑	3.40	
	16.07.21	**0.0**	**2.3**	**19.5**	**0.1**	**1016**→	3.55	
	23.07.21	**0.0**	**3.3**	**17.9**	**0.1**	1005→	4.43	
	19.04.22	**0.1**	2.0	19.0	0.0	1008↑	-	
	05.05.22	**0.1**	**2.8**	**17.5**	**0.1**	**1013**↑	3.86	
WS04	02.07.21	**0.0**	**1.2**	19.5	**0.1**	**1004**→	-	4.0
	09.07.21	**0.0**	1.3	**18.6**	**0.1**	1009↑	3.55	
	16.07.21	**0.0**	**1.2**	19.5	**0.1**	**1016**→	3.70	
	23.07.21	**0.0**	**1.4**	**19.6**	**0.1**	1005→	3.80	
	19.04.22	**0.1**	0.9	20.3	0.0	1008↑	-	
	05.05.22	**0.1**	1.0	20.1	0.0	**1013**↑	-	

↑ rising pressure ↓ falling pressure → steady pressure

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The monitoring visits between 2nd July 2021 and 5th May 2022 were undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 5th May 2021.

Gas Concentrations

With respect to ground gas, the results of the completed monitoring regime indicated a maximum concentration of 0.1% methane, with concentrations of carbon dioxide ranging between 0.1% and 3.3% in association with oxygen levels of between 19.6% and 20.8%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, a maximum flow rate of 0.1 litres per hour was recorded and should be employed in the any calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 1004mb and 1016mb during periods of rising or steady pressures.

In view of the above, it may be appreciated that the continued gas monitoring has revealed no increases in methane concentrations or flow rates. Levels of carbon dioxide have fluctuated slightly during the monitoring in all three boreholes. Furthermore, concentrations of carbon dioxide have been noted to be higher in WS03 than in WS01 and WS04. Therefore, the risk assessment and remediation strategy provided in the geo-environmental report should be considered with the comments below.

Risk Assessment

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% (0.001) methane was recorded along with 3.3% (0.033) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0033 l/hr for carbon dioxide.

In accordance with Table 8.5, *Modified Wilson and Card classification* of the CIRIA report C665, *Assessing risks posed by ground gasses to building,* the site may be characterised as *Characteristic Situation Level 1*. It is therefore considered that there is a very low risk of harm to end users and site operatives and no special precautionary measures are required in accordance to Table 8.6, *Typical scope of gas protection measures,* of CIRIA report C665.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[1]. Accepting that the proposed development is of moderate sensitivity (flats) and that the generation potential is very low, these tables suggest that 6 readings could be undertaken over a period of at least 2 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b.* In this case, a total of 4 monitoring visits were undertaken over a 1-month time period, with a further 2 monitoring visits completed 10 months later.

[1] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*

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In view of the above it is considered that with respect to gas monitoring, the site is fully characterised.

Remediation Strategy for Ground Gas

As a consequence of the above, the site may be characterised as *Characteristic Situation Level 1 (CS1)*. This conclusion was provisionally considered in the geo-environmental report whilst the gas monitoring regime was still underway. On the basis that further monitoring would be necessary to fully characterise the site, recommendations were discussed regarding protection appropriate for *Characteristic Situation Level 1*. This was to ensure that the most onerous possible costs were considered but also to provide appropriate recommendations in case the further monitoring could not be completed. In this instance, it should be appreciated that the final monitoring regime has reinforced the characterisation of a very low risk. As such, no specific remediation will be required to protect against bulk ground gases.

References

- British Standards Institution (2013), BS 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.
- CIRIA Report C665, *Assessing risks posed by ground gasses to building.*

We trust that this information is of interest and should you have any other requirements do not hesitate to contact us.

For Rogers Geotechnical Services Ltd,

Yours Faithfully

Hattie Henshall BSc, FGS
Graduate Engineer

Scott Alexander BSc FGS
Geo-Environmental Engineer