Our Ref C1570/22/E/GM
28th February 2023

Huddersfield Taxis
55 Wakefield Road,
Huddersfield
HD5 9AB

For the attention of Jeremy Child,

Dear Sir,

Ref: Land adjacent to 63 Wakefield Road, Moldgreen, Huddersfield, HD5 9AB.

Further to our report on a geo-environmental investigation (C1570/21/E/2498) which was presented in February 2022, we have now completed the gas monitoring and present our findings.

Monitoring

Gas monitoring standpipes were installed to 3m depth in WS1, WS2 and WS3, the locations of which are provided on the site plan presented as Appendix 1 of the geo-environmental report. Visits were made to the site between the 28th January and the 14th April 2022. The results of this work are tabulated below.

Table 1: Gas monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/hr)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS1	28/01/22	0.1	0.8	20.1	0.1	1020↓	-	3.0
	04/02/22	0.1	0.7	20.9	0.0	999→	-	
	11/02/22	0.1	0.5	20.6	0.1	1025↑	-	
	18/02/22	Unable to access – vehicle parked over location						
	18/03/22	0.1	0.6	20.1	0.1	1036↓	-	
	14/04/22	0.1	0.4	20.5	0.2	1015↑	-	
WS2	28/01/22	0.1	0.1	21.5	0.1	1025↓	-	3.0
	04/02/22	0.1	0.1	21.5	0.0	1000→	-	
	11/02/22	0.1	0.2	21.2	0.1	1025↑	-	
	18/02/22	0.1	0.3	21.1	0.1	*970↓	2.68	
	18/03/22	0.1	0.2	21.2	0.1	1036↓	-	
	14/04/22	0.1	0.4	20.7	0.2	1015↑	-	
WS3	28/01/22	0.1	0.1	21.5	0.1	1025↓	-	3.0
	04/02/22	0.1	0.1	21.4	0.0	1000→	-	
	11/02/22	0.1	0.2	20.8	0.1	1025↑	-	
	18/02/22	0.1	0.2	21.1	0.1	970↓	2.64	
	18/03/22	0.1	0.1	21.3	0.0	1036↓	-	
	14/04/22	0.1	0.1	21.0	0.2	1015↑	-	

↑ rising pressure ↓ falling pressure → steady pressure

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The monitoring was 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 0.8% in association with oxygen levels of between 20.1% and 21.5%. 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 0.2 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 970mb and 1036mb.

In view of the above, it may be appreciated that the continued gas monitoring has revealed no increases in methane concentrations or flow rates. Moreover, the monitoring has been undertaken both during periods of falling pressure and where the barometric pressure has been below 1000mb. As such, 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 0.8% (0.019) carbon dioxide, in association with a maximum flow rate of 0.2 l/hr. This results in a GSV of 0.0002 l/hr for methane and a GSV of 0.0016 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].

[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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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 6 monitoring visits were undertaken over a three month time period.

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*. This conclusion was provisionally considered in the geo-environmental report. However, on the basis that further monitoring would be necessary to fully characterise the site, recommendations were discussed regarding protection appropriate for *Characteristic Situation Level 2*. 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 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,

Imran Sakoor BEng FGS
Geo-environmental Engineer

Rob Palmer MSc FGS ACIEH
Senior Geo-Environmental Engineer

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Rogers Geotechnical Services Ltd

GAS/WATER MONITORING - SITE RECORD

Client Hudderfield Taxis

Site Land adj. 63 Wakefield Road, Huddersfield

Input by : T. Merry

Date : 28.01.2022

Gas Monitor: Geotech GA5000
Serial No. G503524
Calibration Date: 05.05.2021
Dip Meter: 003

(If second monitor is used)

Gas Monitor:
Serial No.
Calibration Date:
Dip Meter

Borehole No	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/hr)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)	Depth During Visit	Atmospheric Conditions	COMMENTS
WS1	28.01.22	**0.1**	**0.8**	**20.1**	0.1	1020	_	3 00	3.03	Overcast	Falling pressure (reading taken in afternoon)
	04.02.22	**0.1**	0.7	20 9	0.0	999	_		3.03	Intermittent Cloud	Steady pressure
	11.02.22	**0.1**	0 5	20 6	0.1	1025	_		3.02	Sunny but Cold	Sharp peak Pressure
	18.02.22	_	_	_	_	_	_		_	_	Car parked over Borehole - no access
	18.03.22	**0.1**	0 6	**20.1**	0.1	**1036**	_		3.02	Clear	Falling pressure
	14.04.22	**0.1**	0.4	20 5	**0.2**	1015	_		3.02	Overcast	Rising Pressure
WS2	28.01.22	**0.1**	**0.1**	**21.5**	0.1	1025	_	3 00	2.99	Overcast	Falling pressure (reading taken in morning)
	04.02.22	**0.1**	**0.1**	**21.5**	0.0	1000	_		2.99	Intermittent Cloud	Steady pressure
	11.02.22	**0.1**	0 2	21 2	0.1	1025	_		2.99	Sunny but Cold	Sharp peak Pressure
	18.02.22	**0.1**	0 3	21.1	0.1	**970**	2 68		2.99	Sunny and Spitting	Falling pressure
	18.03.22	**0.1**	0 2	21 2	0.1	**1036**	_		2.99	Clear	Falling pressure
	14.04.22	**0.1**	0.4	20.7	**0.2**	1015	_		2.99	Overcast	Rising Pressure
WS3	28.01.22	**0.1**	**0.1**	**21.5**	0.1	1025	_	3 00	3.07	Overcast	Falling pressure (reading taken in morning)
	04.02.22	**0.1**	**0.1**	21.4	0.0	1000	_		3.02	Intermittent Cloud	Steady pressure
	11.02.22	**0.1**	0 2	20 8	0.1	1025	_		3.01	Sunny but Cold	Sharp peak Pressure
	18.02.22	**0.1**	0 2	21.1	0.1	**970**	2 64		3.01	Sunny and Spitting	Falling pressure
	18.03.22	**0.1**	**0.1**	21 3	0.0	**1036**	_		3.02	Clear	Falling pressure
	14.04.22	**0.1**	**0.1**	21 0	**0.2**	1015	_		3.02	Overcast	Rising Pressure