Our Ref C2842/22/E/GM
8th of November 2022

MPH Building Systems Ltd
Hoyers Industrial Estate
517 Leeds Road
Huddersfield
West Yorkshire
HD2 1YJ

For the attention of Sean Broughan

Dear Sean

Ref: Gas Monitoring at Upper Batley High School

Further to our report on a geo-environmental investigation (C626/20/E/917) which was presented in August 2022, we have now completed the fourth round of gas monitoring and present our findings.

Monitoring

Gas monitoring standpipes were installed between 2m and 3m depth in boreholes WS1, WS2 and WS3, and the installation details are shown on the appropriate borehole, 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 1st of August and 24 h of August 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	01.08.2022	0.0	0.4	19.4	0.0	1007→	-	2.1
	08.08.2022	0.0	0.5	19.4	0.0	1017→	-	
	15.08.2022	0.1	0.3	20.2	0.1	990→	-	
	24.08.2022	0.0	0.4	20.5	0.0	1004↑	-	
WS02	01.08.2022	0.0	0.5	19.7	0.0	1007→	-	3.1
	08.08.2022	0.0	0.4	19.7	0.0	1016→	-	
	15.08.2022	0.0	0.3	19.9	0.0	991→	-	
	24.08.2022	0.0	0.4	20.6	0.0	1003↑	-	
WS03	01.08.2022	0.0	0.7	19.8	0.0	1007→	-	2.1
	08.08.2022	0.1	0.8	20.0	0.0	1017→	-	
	15.08.2022	0.0	0.5	19.6	0.0	991→	-	
	24.08.2022	0.0	0.7	20.5	0.0	1004↑	-	

↑ rising pressure ↓ falling pressure → steady pressure

The monitoring visits were undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 21st of July 2022.

Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated 0.1% methane, with concentrations of carbon dioxide ranging between 0.3% and 0.7%, in association with oxygen levels of between 19.4% and 20.6%. 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 will be employed in the following 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 990mb and 1017mb.

In view of the above, it may be appreciated that the continued gas monitoring has revealed no increases in methane or carbon dioxide concentrations or flow rates. 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 0.7% (0.007) 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 0.0007 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 and that the generation potential is very low, these tables suggest that 6 readings could be undertaken over a period of 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.* Indeed, given the very low gas concentrations, and taking into consideration the barometric pressure trends recorded during the monitoring, it is considered that sufficient monitoring has been completed. To that affect, it should be noted that the gas screening value threshold for Characteristic Situation level 1, is <0.07 l/hr. Assuming the flow rate remains constant at 0.1l/hr the gas concentration would need to exceed 70% to move into the next risk band, which is extremely unlikely. Moreover, by keeping the concentration constant, the flow rate would need to increase to 10 l/hr which represents a one hundred fold increase. It is considered that these increases are not feasible given the flow rates and gas concentrations encountered. In view of the above it is considered that with respect to gas monitoring, the site is fully characterised, and Characteristic Situation Level 1 may be adopted.

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. It should be noted that the local authority are the final arbiters on such matters, so this letter should be submitted for review.

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

Rob Palmer MSc FGS ACIEH
Senior Geo-environmental Engineer

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