

By Email

Our ref: 19-161.01L

John Richie
Kirklees Council
Investment and Regeneration Service
PO Box B93
Civic Centre
Off Market Street
Huddersfield
HD1 2JR

16th July 2019

Dear John,

Re: 46 Stile Common Road, Huddersfield

Following completion of the recent investigation works at the aforementioned location, we have pleasure in providing you with our brief ground investigation report. The following documents are attached with this report;

- Borehole Location Plan
- Ground Gas Monitoring Certificate

1.0 Introduction:-

In order to determine the risks of hazardous ground gases within the proposed development at 46 Stile Common Road, Arc Environmental Limited were commissioned by Mr Kashif Raheel, to carry out a programme of ground gas monitoring to determine the potential risks of hazardous ground gas migration associated with shallow coal workings. The intrusive investigation works undertaken by Arc Environmental Limited comprised 4 no. windowless sampling boreholes (BH1, BH1A, BH2 & BH3) incorporating the installation of combined gas and groundwater monitoring wells within BH1A, BH2 & BH3, the positions of which can be seen on the borehole location plan attached. This plan should be used for orientating purposes only, as the positions shown are approximate and the plan is not to a standard scale.

2.0 Insitu Gas & Groundwater Monitoring:-

When considering the site is underlain by the Lower Coal Measures, to determine the potential hazardous ground gas regime below the site associated with potential shallow coal workings, soil gas & water monitoring standpipes were installed within BH1A, BH2 & BH3 primarily to check for the possible presence of hazardous ground gas migration, as well as to monitor insitu groundwater levels.

A standard 50mm diameter HDPE standpipe, with gravel and/or geo-wrap surround, bentonite seal, gas valve cap and security cover, was installed within each borehole, and the soil gas and water levels were allowed to reach equilibrium, prior to the first monitoring visit. Monitoring was undertaken using a GFM 430 / 435 series soil gas analyser, with integral flow meter, and a Geotechnical Instruments electronic dip-meter.



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Re: 46 Stile Common Road, Huddersfield (Cont'd)

2.0 Insitu Gas & Groundwater Monitoring (Cont'd):-

In accordance with CIRIA Report C665, November 2007, the current NHBC Document; Guidance on evaluation of development proposals on site where methane and carbon dioxide are present, Report Edition No. 04, March 2007 and BS8485:2015+A1 2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, the risk assessment for this site has been based on the following limiting factors:

- The Residential development has been considered as **high** sensitivity (Table 5.5 – Typical/Idealised frequency and period of monitoring, after Wilson et al, 2005).
- The risk associated with the generation potential of a source is considered as **very low**, (assessment based on the environmental setting).
- Monitoring over a minimum of **three months** with **six** recorded readings (Table 5.5 – Typical /idealised frequency and period of monitoring after Wilson et al, 2005).
- Negligible flow rates have been recorded (Table 8.5 – Modified Wilson & Card classification).
- A targeted and phased program of gas monitoring has been completed obtaining gas monitoring readings during varying atmospheric conditions, which covers the 'worst case' scenario for ground gas emissions to occur, particularly during rapid falls in atmospheric pressure (i.e. from c.1020mb and c.1010mb).

Monitoring of the weather conditions and predicated atmospheric pressures (Met Office Surface Pressure Charts) are carried out up to 72 hours in advance of proposed monitoring visits, in order that a reasonable period of data is obtained to determine atmospheric trends, and also to target the 'worst case' scenario. A summary of the results for the 6 no. visits undertaken, compared with the 'inert' background gas levels are presented in Table 2 on the following page with a copy of the monitoring certificate attached.

As can be seen from the results undertaken, no concentrations of Methane (CH₄) were recorded within any of the boreholes. However, detectable levels of Carbon Dioxide (CO₂) were recorded within the boreholes, up to a maximum level of 2.3% v/v, with associated slightly depleted oxygen (O₂) concentrations (minimum 17.3% v/v). In addition, negligible flow rates of <0.1l/hr have been recorded during the monitoring visits completed to date.

Based upon the results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results in Table 2 to gas screening values (GSV's), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates (after Wilson & Card). As no levels of CH₄ have been recorded to date, the gas screening value (GSV) for CO₂ only has been calculated, using the maximum recorded value of 2.3% v/v, with a maximum flow rate of 0.1l/hr. The GSV can be calculated as follows:

$$\text{Carbon Dioxide GSV} = 0.023 (2.3\%) \times 0.1 = 0.0023 \text{ l/hr}$$

When considering these results, in accordance with CIRIA C665, and considering the NHBC Traffic light system (low rise housing with ventilated underfloor void), it can be seen that the GSV value for CO₂ is below the assessment GSV of 0.78 l/hr (Green classification), resulting in no gas protection measures being required.

Re: 46 Stile Common Road, Huddersfield (Cont'd)

2.0 Insitu Gas & Groundwater Monitoring (Cont'd):-

Alternatively, if the proposed development were to comprise ground bearing floor slabs within the structures, in accordance with CIRIA C665, the GSV for CO₂ would also fall below the lower target concentration of 0.07l/hr and would equate to a Characteristic Situation 1 site classification, resulting in no gas protective measures being required for the proposed development.

Table 2

* Atmospheric trend taken from www.weatheronline.com for Leeds Bradford Airport.

Position	Date	Atmospheric Pressure (mbar)	Water (m bgl)	CH ₄ (%v/v)	LEL (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Flow Rate (l/hr)
Background		~	~	0	0	0	21.0	0
BH1A	29/04/2019	1009	Dry	0.0	0.0	0.5	20.3	<0.1
BH2		(*trend - Falling 1028-1005)	Dry	0.0	0.0	0.6	20.3	<0.1
BH3			Dry	0.0	0.0	0.2	20.6	<0.1
BH1A	13/05/2019	1022-1023	Dry	0.0	0.0	1.1	20.3	<0.1
BH2		(*trend - Falling 1038-1021)	Dry	0.0	0.0	1.3	20.3	<0.1
BH3			Dry	0.0	0.0	0.3	20.0	<0.1
BH1A	28/05/2019	993	Dry	0.0	0.0	0.2	20.3	<0.1
BH2		(*trend - Rising 1005-1015)	Dry	0.0	0.0	0.1	20.3	<0.1
BH3			Dry	0.0	0.0	0.1	20.1	<0.1
BH1A	13/06/2019	991	1.20	0.0	0.0	2.3	17.9	<0.1
BH2		(*trend - Falling 1018-1003)	1.77	0.0	0.0	0.4	19.9	<0.1
BH3			1.70	0.0	0.0	1.9	18.3	<0.1
BH1A	24/06/2019	1012	Dry	0.0	0.0	0.2	20.2	<0.1
BH2		(*trend - Rising 1018-1030)	Dry	0.0	0.0	0.3	20.1	<0.1
BH3			Dry	0.0	0.0	1.6	18.9	<0.1
BH1A	03/07/2019	1018	Dry	0.0	0.0	0.5	20.4	<0.1
BH2		(*trend - Falling 1028-1012)	Dry	0.0	0.0	0.5	20.4	<0.1
BH3			Dry	0.0	0.0	2.2	17.3	<0.1

When considering the results of the groundwater monitoring, standing levels were recorded at depths of between c.1.20m to c.1.77m during the visit completed on 13th June 2019, with the boreholes remaining dry during the remaining visits. These levels are likely to be reflective of 'perched' water collecting within the standpipes which will be effectively acting as a conduit for trapped surface infiltration rather than representing a shallow continuous groundwater surface below the site.

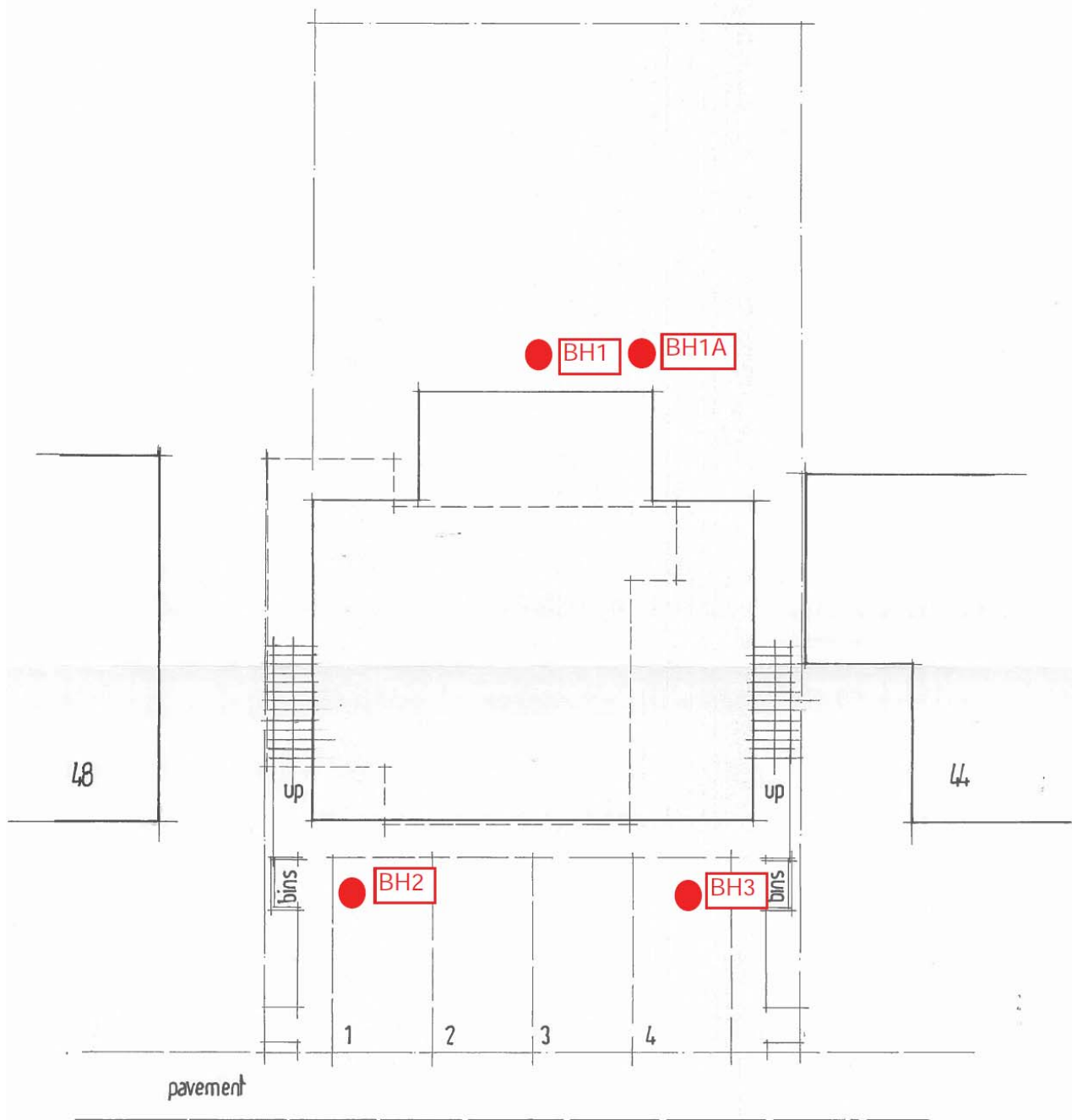
We trust the contents of this brief report is to your satisfaction and if you require any further information or clarification please do not hesitate to contact us.

Yours sincerely,



For and on behalf of Arc Environmental Ltd
Darren McGrath MEnvSc FGS MNEIMME Tech IOSH
Director

Borehole Location Plan



Ground Investigation Report

Borehole Location Plan (Not to Scale)



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CLIENT: Mr Kashif Raheel

PROJECT REF: 19-161

SITE NAME: 46 Stile Common Road, Huddersfield.

Gas Monitoring Certificate

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Arc Environmental Ground Gas & Groundwater Monitoring Certificate



Site:	19-161
Ref:	46 Stile Common Road, Huddersfield

Visit	Date	Time	Equipment	Weather	Initials	Comments	Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Trend	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Hydrocarbons (GFM 435 only)		Other Gases (PPM)			Depth to Water (m bgl)
											Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Hex %	PID Cf	PID (Isobutylene)	H ₂ S	CO	
1	29/04/2019	12.20PM	GFM435	Overcast, Dry	KC		1	<0.1	1009	Falling (1028-1005)		0.0		0.0		0.5		20.3				0.0	0.0	1.36dry
							2	<0.1	1009	Falling (1028-1005)		0.0		0.0		0.6		20.3				0.0	0.0	1.96dry
							3	<0.1	1009	Falling (1028-1005)		0.0		0.0		0.2		20.6				0.0	0.0	1.83damp
2	13/05/2019	10.55AM	GFM435	Sunny	KC		1	<0.1	1023	Falling (1038-1021)		0.0		0.0		1.1		20.3				0.0	0.0	DRY
							2	<0.1	1022	Falling (1038-1021)		0.0		0.0		1.3		20.3				0.0	0.0	DRY
							3	<0.1	1022	Falling (1038-1021)		0.0		0.0		0.3		20.0				0.0	0.0	DRY
3	28/05/2019	1.40PM	GFM435	Mostly Cloudy	KC		1	<0.1	993	Rising (1005-1015)		0.0		0.0		0.2		20.3				0.0	0.0	DRY
							2	<0.1	993	Rising (1005-1015)		0.0		0.0		0.1		20.3				0.0	0.0	DRY
							3	<0.1	993	Rising (1005-1015)		0.0		0.0		0.1		20.1				0.0	0.0	DRY
4	13/06/2019	1.15PM	GFM430	Light Rain	KC		1	<0.1	991	Falling (1018-1003)		0.0		0.0		2.3		17.9				0.0	0.0	1.20
							2	<0.1	991	Falling (1018-1003)		0.0		0.0		0.4		19.9				0.0	0.0	1.77
							3	<0.1	991	Falling (1018-1003)		0.0		0.0		1.9		18.3				0.0	0.0	1.70
5	24/06/2019	10.30AM	GFM430	Slight overcast	KC		1	<0.1	1012	Rising (1018-1030)		0.0		0.0		0.2		20.2				0.0	0.0	Dry
							2	<0.1	1012	Rising (1018-1030)		0.0		0.0		0.3		20.1				0.0	0.0	Dry
							3	<0.1	1012	Rising (1018-1030)		0.0		0.0		1.6		18.9				0.0	0.0	Dry
6	03/07/2019	2.00PM	GFM43	Sunny, 22oC, Dry, V.slight breeze	RS		1	<0.1	1018	Falling (1028-1012)		0.0		0.0		0.5		20.4				0.0	0.0	Dry
							2	<0.1	1018	Falling (1028-1012)		0.0		0.0		0.5		20.4				0.0	0.0	Dry
							3	<0.1	1018	Falling (1028-1012)		0.0		0.0		2.2		17.3				0.0	0.0	Dry

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr
Monitoring order is from **Left to Right** across table
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes
N/A = Not applicable = Off the scale

Cf = PID compensation Factor (1-10) - Must be used to multiply the PID reading to give an accurate measure of the total hydrocarbons in the borehole when methane is present
Hex = Hexane (Valid and in range up to 2.000%) - Recorded when abnormally high methane is present.
PID = Photo Ionisation Detector (Calibrated to Isobutylene)