By Email

Our ref: 16-911.01L

Chris Wardell
Gus Robinson Developments Ltd
Stranton House
West View Road
Hartlepool
TS24 0BW

Solum House
Unit 1 Elliott House
St John's Road
Meadowfield
DH7 8PN

4th July 2017

Dear Chris,

Re: Proposed Residential Development, Gordon House, Gordon Street, South Shields – Hazardous Ground Gas Risk Assessment Addendum Report

This letter report is an addendum to the Ground Investigation Report (GIR) (Project No.: 16-911, January 2017) undertaken for the proposed development at the above location.

Please find enclosed:

- ARC Environmental Ground Gas Monitoring Certificate

Monitoring was undertaken using a Gas Data GFM 430 & 435 infra-red gas analyser with integral flow meter, and an electronic dipmeter.

Based on the Phase 1: Desk Top Study report and findings of the intrusive investigation works, in accordance with CIRIA Report C665, November 2007, Report Edition No. 04, March 2007 and BS8485:2015: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- The development has been considered as **high sensitivity** i.e. Residential development (Tables 5.5a & 5.5b – 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 findings of intrusive works).
- Monitoring over a **minimum** of **three months** with **six recorded** readings (Tables 5.5a & 5.5b – Typical /idealised frequency and period of monitoring after Wilson et al, 2005).
- **Negligible** flow rates are recorded during the monitoring period (Table 8.5 – Modified Wilson & Card classification).

Re: Proposed Residential Development, Gordon House, Gordon Street, South Shields – Hazardous Ground Gas Risk Assessment Addendum Report (Cont'd)

Historically, site visits to undertake gas monitoring were typically carried out at regular intervals (i.e. weekly, fortnightly, monthly, etc.), however this does not always correlate with 'worst case' scenarios for falling atmospheric conditions. Within CIRIA C665 it is suggested that a 'worst case' scenario for ground gas emissions is more likely to occur during rapid falls in atmospheric pressure, in particular from c.1020mb and c.1010mb. In addition, it has also been suggested that low atmospheric pressures (i.e. c.1000mb and below) can give rise to greater emission potential for lighter gases, in particular methane.

As such for this monitoring, a targeted and phased programme of gas monitoring has been completed which has obtained gas monitoring readings during varying atmospheric conditions and which also covers the 'worst case' scenarios. The majority of the monitoring visits correlate to worst case conditions with falling atmospheric pressure trends, and/or atmospheric pressures near or below 1000mb. As such it is felt that this programme of monitoring has adequately characterised the site. The monitoring results for all 6 no. visits undertaken can be seen attached with this report.

As can be seen from the results, no concentrations of Methane (CH_4) have been detected. Concentrations of Carbon Dioxide (CO_2) have been recorded up to a maximum level of 0.7% *v/v*, with reduced Oxygen (O_2) concentrations (minimum 19.3% *v/v)*. Negligible flow rates (<0.1 l/hr.) have been recorded on all occasions.

The site is characterised based on the limiting borehole gas volume flow for Methane and Carbon Dioxide, known as the Gas Screening Value (GSV), which in turn determines the level of any gas protection required. Therefore, in order to complete the risk assessment, the maximum GSV (Gas Screening Value) for the CH_4 and CO_2 levels recorded have been determined as follows:

- Methane (CH_4) – Due to the lack of Methane recorded, a GSV cannot be calculated.
- Carbon Dioxide (CO_2) - multiplying the maximum concentration recorded (taken as 0.7%) by the maximum flow rate (taken as 0.1 l/hr.) which gives a GSV of 0.0007 l/hr. (calculated from 0.7% (0.007) x 0.1 l/hr. maximum flow rate) for CO_2.

From the results, it can be seen that hazardous ground gases do not exceed the GSV assessment value of 0.07 l/hr. (Characteristic Situation 1) or 0.78 l/hr. (Green Classification – NHBC Traffic light system), indicating that no gas protection measures would be required for the proposed development.

I trust the information we have provided to you is to your satisfaction. However, 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

……..……
Matt Bradford *BSc. (Hons) FGS*
Senior Engineering Geologist

T: 0191 378 6380
F: 0191 378 0494
E: admin@arc-environmental.com
W: www.arc-environmental.com
Registered in England No. 05539784

Arc Environmental Ground Gas & Groundwater Monitoring Certificate

Site:	Gordon House, South Shields
Ref:	16-911

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)
										R/F/S	Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Hex %	PID Cf	PID (Isobutylene)	H_2S	CO	
1	13/01/2017	9:15am	GFM435	Overcast, wet	IH		1	<0.1	1003	Falling 1029 - 994mb		0.0		0.0		0.0		20.0						Dry
							3	<0.1	1002			0.0		0.0		0.7		19.3						Dry
							5	<0.1	1002			0.0		0.0		0.0		19.9						Dry
2	03/02/2017	10:00am	GFM435	Sunny	IH		1	<0.1	989	Falling 1009 - 985mb		0.0		0.0		0.0		20.1						Dry
							3	<0.1	989			0.0		0.0		0.2		20.1						Dry
							5	<0.1	989			0.0		0.0		0.0		20.0						Dry
3	24/02/2017	9:30am	GFM435	Sunny spells but wet	IH		1	<0.1	1012	Rising 975 - 1016mb		0.0		0.0		0.0		20.0						Dry
							3	<0.1	1012			0.0		0.0		0.2		20.0						Dry
							5	<0.1	1012			0.0		0.0		0.1		19.9						Dry
4	10/03/2017	9:25am	GFM435	Overcast	IH		1	<0.1	1019	Rising 1002 - 1025mb		0.0		0.0		0.0		20.0						Dry
							3	<0.1	1018			0.0		0.0		0.3		19.8						Dry
							5	<0.1	1018			0.0		0.0		0.0		19.9						Dry
5	18/04/2017	3:45pm	GFM430	Sunny spells	IH		1	<0.1	1033	Rising 1009 - 1035mb		0.0		0.0		0.1		19.9						Dry
							3	<0.1	1033			0.0		0.0		0.6		19.5						Dry
							5	<0.1	1033			0.0		0.0		0.1		19.7						Dry
6	05/05/2017	10:45am	GFM435	Sunny	IH		1	<0.1	1025	Falling 1029 - 1016mb		0.0		0.0		0.1		19.9						Dry
							3	<0.1	1025			0.0		0.0		0.4		19.9						Dry
							5	<0.1	1026			0.0		0.0		0.2		19.7						Dry

Notes: * Trend taken from www.wunderground.com for Newcastle Airport

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 accuate 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)