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Our Ref: P6793 GAL

Date: 19th January 2016

Mr Hisham Shibl
Reliant Building Contractors
101 Elm Tree Court
London
NW8 9JT

Dear Hisham,

Re: Gas Completion Report for Land off Saint Mary's Street, Penistone.

The gas monitoring programme at the above site is now complete. The assessment below has been conducted following GRM's Site Investigation Report (ref: GRM/P6793/F.1), dated January 2015. This letter report should be submitted to the regulatory bodies for approval.

As instructed, GRM attended the site on the 17th November 2014 and installed gas monitoring points in six window sample boreholes across the site. 35mm standpipe was installed in the exploratory holes, with response zones targeted at the natural strata and made ground. The exploratory hole location plan and exploratory hole logs are enclosed for reference.

Gas monitoring has been carried out, from 25th November 2014 to 3rd February 2015, to assess the risk posed to end users of the proposed residential development from harmful ground gases. The primary guidance document to determine if gas protection measures are required is BS8485:2015. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive Gas Screening Values (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

As the proposed land use is classed as high sensitivity (residential), six 35mm diameter gas/water monitoring standpipes have been installed across the site in the window sample boreholes (WS01-WS04 and WS6-WS7). Because a potential significant off-site source of ground gas is present adjacent to the site, the response zones have been targeted at the natural strata and the made ground to gain an appreciation of the ground gas regime.

As the gas hazard is considered moderate (old landfill adjacent to the site) the monitoring programme has comprised six visits over three months.

The post fieldwork monitoring has been designed to identify and assess the groundwater and gas regimes below the site. The results are enclosed for reference and are summarised below:

Well ID (No. of Readings)	Response Zone / Strata	Contamination	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (%v/v)	Gas Flow Max (l/h)
WS01 (6)	0.5-1.0m / MG	None.	0.00	0.1-1.9	18.9-21.7	0.1
WS02 (5)	0.5-2.6m / MG	None.	0.00	0.0-5.7	15.6-20.5	0.1
WS03 (6)	1.4-2.7m / NS	None.	0.00	3.2-5.1	0.2-4.9	0.1
WS04 (6)	0.4-0.7m / NS	Benzo(a)pyrene & napthalene.	0.00	0.0-4.5	8.7-21.7	0.1
WS06 (6)	0.5-3.6m / MG	None.	0.00	0.0-0.8	20.2-24.0	0.1
WS07 (6)	0.5-1.0m / MG	None.	0.00	0.0-2.4	18.1-21.7	0.1
Notes: NS= Natural Strata, MG= Made Ground					*Atmospheric Pressure: 970mb-994mb*	

A gas flow rate of 0.1l/hr has been recorded in the following assessment. Methane was not recorded during the monitoring period and so a default concentration of 0.1%v/v has been used in the following assessment.

Using the maximum flow rate of 0.1l/hr and the default methane concentration of 0.1%v/v a Qhg of 0.0001l/hr has been calculated for methane. Using the maximum flow rate of 0.1l/hr and the maximum carbon dioxide concentration of 5.7%v/v, a Q_{hg} of 0.0057l/hr has been calculated for carbon dioxide. On this basis the Q_{hg} GSV for the site is determined as 0.0057l/hr which is CS1.

The worst case GSV is <0.07l/hr, the typical flow rate is <70l/hr, the maximum recorded concentration of methane is <1%v/v, and the maximum concentration of carbon dioxide is slightly over 5%v/v. Therefore, BS8485:2015 states consideration should be given to increasing to 'Characteristic Situation 2' however as the maximum concentration of carbon dioxide is only slightly over 5%v/v then it is considered that increasing to CS2 is not warranted and the site can be classified as 'Characteristic Situation 1' as outlined in table 2 of BS8485:2015, for which gas protection measures **are not** required.

No radon protection measures are required for the proposed development.

The monitoring program has confirmed the presence of relatively shallow groundwater beneath the site, with water being recorded at depths of between 0.5m begl and 1.05m begl, and instances of water not been detected up to the maximum depths of the wells (3.1m begl max in WS01). Results were obtained but not eligible on the fourth visit for WS04, as the response zone was flooded. However, as the results have been relatively consistent throughout the monitoring programme, and the highest ground gas concentrations have been recorded in WS02, WS03 and WS04, it is considered that sufficient data is available to accurately classify the sites' ground gas regime.

Furthermore, depleted concentrations of oxygen have been identified at the site; this is considered to pose a potential risk to site workers entering excavations/confined spaces and should be taken into account in future risk assessment.

We trust this is suitable for you current requirements, should you require any further information or would like any clarification of the points raised please do not hesitate to contact us.

Yours sincerely,
for GRM Development Solutions Ltd

Alex Smith BSc (Hons) FGS
Geologist

Simon Coffey BSc MSc FGS
Principal Environmental Scientist

Enc: P7192 Gas Monitoring Results

APPENDIX A

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

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In-Situ Gas Monitoring Results

Project Name:	Land off St Mary's Street, Penistone.
Project Number:	P6793
Client:	Reliant Building Contractors Ltd
Date:	25 November 2014
Weather:	Dry
Atmospheric Pressure (mb):	994 mb
Pressure Trend:	Rising
Equipment:	Gas Data GFM430
Operator:	Courtney Blockley

Ground Gases														Groundwater	
Borehole / Well	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS01	0.5	1.0	MG	0.00	0.00	1.50	1.50	19.80	19.80	0.00	0.00	N.R.	N.R.	DRY	0.85
WS02	0.5	2.6	MG	0.00	0.00	5.70	4.90	16.00	16.00	0.00	0.00	N.R.	N.R.	DRY	2.39
WS03	1.4	2.7	NS	0.00	0.00	4.10	4.10	1.10	4.70	0.00	0.00	N.R.	N.R.	DRY	2.29
WS04	0.4	0.7	NS	0.00	0.00	1.20	1.20	17.40	17.40	0.00	0.00	N.R.	N.R.	0.80	0.85
WS06	0.5	3.6	MG	0.00	0.00	1.90	0.80	20.20	20.20	0.00	0.00	N.R.	N.R.	DRY	3.01
WS07	0.5	1.0	MG	0.00	0.00	2.00	2.00	18.10	18.10	0.00	0.00	N.R.	N.R.	1.05	1.10

Comments:

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

In-Situ Gas Monitoring Results

Project Name:	Land off St Mary's Street, Penistone.
Project Number:	P6793
Client:	Reliant Building Contractors Ltd
Date:	11 December 2014
Weather:	Rain
Atmospheric Pressure (mb):	970
Pressure Trend:	Rising
Equipment:	Gas Data LMSXi
Operator:	Jem ward

Ground Gases														Groundwater	
Borehole / Well	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS01	0.5	1.0	MG	0.00	0.00	0.70	0.70	20.40	21.70	0.00	0.00	N.R.	N.R.	Dry	0.78
WS02	0.5	2.6	MG												
WS03	1.4	2.7	NS	0.00	0.00	5.10	5.10	0.20	0.20	0.00	0.00	N.R.	N.R.	Dry	2.15
WS04	0.4	0.7	NS	0.00	0.00	3.90	3.10	11.90	19.20	0.00	0.00	N.R.	N.R.	Dry	0.73
WS06	0.5	3.6	MG	0.00	0.00	0.20	0.20	21.20	22.00	0.00	0.00	N.R.	N.R.	Dry	3.02
WS07	0.5	1.0	MG	0.00	0.00	0.70	0.30	21.20	21.60	0.00	0.00	N.R.	N.R.	0.59	0.95

Comments: WS02 Flooded

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

In-Situ Gas Monitoring Results

Project Name:	Land off St Mary's Street, Penistone.
Project Number:	P6793
Client:	Reliant Building Contractors Ltd
Date:	23 December 2014
Weather:	Dry
Atmospheric Pressure (mb):	978
Pressure Trend:	Steady
Equipment:	Gas Data LMSXi
Operator:	Dave Evans

Ground Gases														Groundwater	
Borehole / Well	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS01	0.5	1.0	MG	0.00	0.00	2.00	1.90	18.90	18.90	0.10	0.10	N.R.	N.R.	ND	0.80
WS02	0.5	2.6	MG	0.00	0.00	5.70	5.70	15.60	15.60	0.10	0.10	N.R.	N.R.	ND	2.36
WS03	1.4	2.7	NS	0.00	0.00	3.60	3.50	1.50	1.50	0.10	0.10	N.R.	N.R.	ND	2.20
WS04	0.4	0.7	NS	0.00	0.00	4.50	4.50	8.70	8.70	0.10	0.10	N.R.	N.R.	ND	0.85
WS06	0.5	3.6	MG	0.00	0.00	0.30	0.30	21.20	21.20	0.10	0.10	N.R.	N.R.	ND	3.10
WS07	0.5	1.0	MG	0.00	0.00	2.40	2.40	19.40	19.40	0.10	0.10	N.R.	N.R.	0.67	1.05

Comments:

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

In-Situ Gas Monitoring Results

Project Name:	Land off St Mary's Street, Penistone.
Project Number:	P6793
Client:	Reliant Building Contractors Ltd
Date:	08 January 2015
Weather:	Wet
Atmospheric Pressure (mb):	992
Pressure Trend:	Rising
Equipment:	Gas Data LMSXi
Operator:	Russell Hurcombe

Ground Gases														Groundwater	
Borehole / Well	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS01	0.5	1.0	MG	0.00	0.00	1.00	0.80	20.30	20.30	0.00	0.00	N.R.	N.R.	N.D.	0.80
WS02	0.5	2.6	MG	0.00	0.00	4.50	4.30	17.00	17.10	0.00	0.00	N.R.	N.R.	N.D.	2.35
WS03	1.4	2.7	NS	0.00	0.00	3.60	3.20	0.80	2.90	0.00	0.00	N.R.	N.R.	N.D.	2.18
WS04	0.4	0.7	NS	0.00	0.00	0.00	0.00	11.20	21.30	0.00	0.00	N.R.	N.R.	0.00	0.79
WS06	0.5	3.6	MG	0.00	0.00	0.10	0.10	20.70	20.70	0.00	0.00	N.R.	N.R.	N.D.	2.94
WS07	0.5	1.0	MG	0.00	0.00	2.10	1.00	18.40	19.40	0.00	0.00	N.R.	N.R.	0.75	1.04

Comments: WS04 - cover needs resetting

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

In-Situ Gas Monitoring Results

Project Name:	Land off St Mary's Street, Penistone.
Project Number:	P6793
Client:	Reliant Building Contractors Ltd
Date:	19 January 2015
Weather:	Snow
Atmospheric Pressure (mb):	984
Pressure Trend:	Falling
Equipment:	Gas Data LMSXi
Operator:	Dave Evans

Ground Gases														Groundwater	
Borehole / Well	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS01	0.5	1.0	MG	0.00	0.00	0.60	0.60	20.60	20.60	0.10	0.10	NR	NR	ND	0.80
WS02	0.5	2.6	MG	0.00	0.00	5.40	5.40	17.70	17.70	0.10	0.10	NR	NR	ND	2.36
WS03	1.4	2.7	NS	0.00	0.00	3.60	3.20	0.80	2.90	0.01	0.01	N.R.	N.R.	N.D.	2.18
WS04	0.4	0.7	NS	0.00	0.00	0.10	0.10	19.90	19.90	0.10	0.10	NR	NR	0.53	0.80
WS06	0.5	3.6	MG	0.00	0.00	0.40	0.40	24.00	24.00	0.10	0.10	NR	NR	ND	3.00
WS07	0.5	1.0	MG	0.00	0.00	2.10	2.10	19.90	19.90	0.10	0.10	NR	NR	0.65	1.04

Comments:

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

In-Situ Gas Monitoring Results

Project Name:	Land off St Mary's Street, Penistone.
Project Number:	P6793
Client:	Reliant Building Contractors Ltd
Date:	3rd February 2015
Weather:	Snow
Atmospheric Pressure (mb):	*Number 988 mb
Pressure Trend:	
Equipment:	Gas Data LMSXi
Operator:	Jem Ward

Ground Gases														Groundwater	
Borehole / Well	Response Zone (mbegl)			Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)		Depth to Groundwater (mbegl)	Total Well Depth (mbegl)
	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady		
WS01	0.5	1.0	MG	0.00	0.00	0.30	0.10	21.00	21.50	0.00	0.00	N/R	N/R	dry	0.80
WS02	0.5	2.6	MG	0.00	0.00	1.80	0.00	21.30	20.50	0.00	0.00	N/R	N/R	dry	2.33
WS03	1.4	2.7	NS	0.00	0.00	3.40	3.30	4.70	4.90	0.00	0.00	N/R	N/R	dry	2.10
WS04	0.4	0.7	NS	0.00	0.00	0.00	0.00	21.50	21.70	0.00	0.00	N/R	N/R	0.50	0.70
WS06	0.5	3.6	MG	0.00	0.00	0.00	0.00	21.30	21.70	0.00	0.00	N/R	N/R	dry	3.00
WS07	0.5	1.0	MG	0.00	0.00	0.10	0.00	21.30	21.70	0.00	0.00	N/R	N/R	0.66	1.00

Comments: #E.g. WS1 Destroyed / flooded / not found / bung missing#

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)	Highlighted cell for following conditions:	
N.D.	Not Detected	a.	Methane ≥1% v/v
N.R.	Not Recorded	b.	Carbon Dioxide ≥5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata