

GRM Development Solutions Ltd
Laurus House
First Avenue
Centrum 100
Burton upon Trent
Staffordshire
DE14 2WH

Telephone: (01283) 551249
Fax: (01283) 211968
Date: 18th July 2014
Our Ref: P6547 AJP-1

The Alan Johnston Partnership
4th Floor
1 Dale Street
Liverpool
L2 2ET

Attention of Mr. J. Smith

Dear Jonathan,

Re: Gas Protection Measures for Island Road South, Garston, Liverpool

The gas monitoring programme at the above site is now complete. The assessment below supersedes the information in the Site Appraisal Report and should be submitted to the regulatory bodies for approval.

Gas monitoring has been carried out to assess the risk posed to the end user from harmful ground gasses. The primary guidance document to determine if protection measures are required is CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' (2007). This uses Gas Screening Values (GSVs), which are gas concentrations multiplied by borehole flow rate, along with additional limiting factors (such as maximum methane concentrations) to classify the gas regime of a site.

The guidance document includes two methods of characterising a site. The main method 'Situation A' is based on work by Wilson and Card and is used for all types of development except low rise housing that meets the assumptions of 'Situation B'. The 'Situation B' method proposed by Boyle and Witherington for the NHBC assumes all properties have pre-cast suspended floors (beam and block) with ventilated under floor voids.

For this site, as the proposed development is residential and is likely to include a number of different floor types, the risk from ground gases has been assessed using both 'Situation A' and 'Situation B'.

As the proposed end use has been classified as high sensitivity (residential with gardens). Six gas/water monitoring standpipes have been installed across the site (WS1, WS3, WS4, WS5, WS8 and WS9). The 35mm standpipes have been installed in window sampling boreholes with response zones targeted at the made ground or natural strata.

No obvious deleterious material was observed during the ground investigation and only in WS1 was the made ground observed to exceed a thickness of 1m. As the gas hazard is considered very low the monitoring programme has comprised six visits over three calendar 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.

Borehole	Response Zone (m begl) / Strata	Contamination	No. of Monitoring Visits	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (%v/v)	Flow (l/hr)	Atmospheric Pressure Range (mb)
WS1	1.5m-3m Nat	None	6	0	6.1-14	9.5-13.7	0	997- 1024
WS3	1m-3m / Nat	None	6	0	3.8-8.6	6.5-16.4	0	997- 1024
WS4	1m-3m / Nat	None	6	0	0.9-3.9	18.8- 20.2	0	997- 1024
WS5	1m-3m / Nat	None	6	0	1.2-4.7	17.9-20	0	997- 1024
WS8	0.2m- 0.8m / MG	Made ground	6	0	1.7-5.7	16.3- 18.4	0	997- 1024
WS9	1m-3m / Nat	None	6	0	1.4-9.3	13.8- 19.6	0	997- 1024

MG= Made ground Nat= Natural Strata

No flow has been recorded during the gas monitoring programme. Therefore, to produce a definite result a default flow rate of 0.1l/hr has been used in the following assessment.

Using the default borehole flow rate of 0.1l/hr and the maximum carbon dioxide concentration of 14%v/v, a GSV of 0.014l/hr has been calculated for carbon dioxide. No elevated concentrations of methane have been recorded. The site would normally be assessed as 'Characteristic Situation 1' or 'Traffic Light Green' as outlined CIRIA C665. However, because the level of carbon dioxide is above 5% consideration should be given to increasing the level of protection to that of 'Characteristic Situation 2' or 'Traffic Light Amber 1'.

Therefore, it is considered that gas protection measures are required for the proposed development; these should comprise:

- Reinforced cast in situ floor slab (suspended, ground bearing or raft), low permeability gas membrane, under floor venting (pipes) and sealed joints/service entries.

OR

- Pre-cast (beam and block) concrete floor, low permeability gas membrane, underfloor venting and sealed joints/service entries.

In addition to the above recommendations all gas protection measures should be designed in accordance with BS8485 'Code of practice for the characterisation and remediation from ground gas affected developments'.

No radon protection measures are required for the proposed development.

Therefore, gas protection measures are required for the proposed development. The recommendations given are consistent with those made in the original report and should not require a redesign of the floorslabs.

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

A handwritten signature in black ink, appearing to read 'P Wardle', is positioned above the typed name.

Yours sincerely,
for GRM Development Solutions Ltd

Paul Wardle BSc
Geologist

Enc: P6547 Gas Monitoring Results

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P6547

SITE. Island Road South, Garston, Liverpool

CLIENT. The Alan Johnston Partnership

DATE. 09-May-14

CONDITIONS. *WEATHER:* CLOUDY / WET / WINDY
ATMOSPHERIC PRESSURE: 1004 mb
PRESSURE TREND: Steady

GRM Development Solutions Limited
 Laurus House
 First Avenue
 Burton-upon-Trent
 Staffordshire
 DE14 2WH

Telephone: (01283) 551 249
 Facsimile: (01283) 211 968
 Email: mail@grm-uk.com

OPERATOR. Alex Smith

EQUIPMENT. LMXSi Gas Data Recorder

RESULTS

Borehole/ Well Ref. No.	Methane (CH ₄) %v/v	Carbon Dioxide (CO ₂) %v/v	Oxygen (O ₂) %v/v	Flow (l/hr)	L.E.L (%)	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	6.1	13.7	0	0	2.5	3.1
WS3	0.0	3.8	14.7	0.0	0.0	3.10	3.10
WS4	0.0	0.9	20.2	0.0	0.0	0.81	2.60
WS5	0.0	1.2	20.0	0.0	0.0	0.91	3.10
WS8	0.0	1.7	17.8	0.0	0.0	DRY	0.80
WS9	0.0	1.7	19.5	0.0	0.0	1.09	2.80

Notes

L.E.L. Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 % By Volume

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P6547

SITE. Island Road South, Garston, Liverpool

CLIENT. The Alan Johnston Partnership

DATE. 19-May-14

CONDITIONS. *WEATHER:* Sunny / Cloudy
ATMOSPHERIC PRESSURE: 997 mb
PRESSURE TREND: Steady

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE14 2WH

Telephone: (01283) 551 249
Facsimile: (01283) 211 968
Email: mail@grm-uk.com

OPERATOR. Alex Smith

EQUIPMENT. LMXSi Gas Data Recorder

RESULTS

Borehole/ Well Ref. No.	Methane (CH ₄) %v/v	Carbon Dioxide (CO ₂) %v/v	Oxygen (O ₂) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	7.2	11.7	0.0	0.0	2.50	3.00
WS3	0.0	4.7	12.9	0.0	0.0	2.20	3.00
WS4	0.0	1.2	20.0	0.0	0.0	0.84	2.50
WS5	0.0	1.4	19.8	0.0	0.0	0.84	3.00
WS8	0.0	2.4	18.4	0.0	0.0	0.74	2.80
WS9	0.0	1.5	19.6	0.0	0.0	1.16	2.80

Notes

L.E.L. Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
N.D. Not Detected
N.R. Not Recorded
% By Volume

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P6547

SITE. Island Road South, Garston, Liverpool

CLIENT. The Alan Johnston Partnership

DATE. 06-Jun-14

CONDITIONS. *WEATHER:*
ATMOSPHERIC PRESSURE: 1006 mb
PRESSURE TREND:

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE14 2WH

Telephone: (01283) 551 249

Facsimile: (01283) 211 968

Email: mail@grm-uk.com

OPERATOR. Alex Smith

EQUIPMENT. LMXSi Gas Data Recorder

RESULTS

Borehole/ Well Ref. No.	Methane (CH ₄) %v/v	Carbon Dioxide (CO ₂) %v/v	Oxygen (O ₂) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	7.5	9.8	0.0	0.0	3.00	3.10
WS3	0.0	6.3	8.1	0	0	1.75	3.09
WS4	0.0	1.8	19.3	0.0	0.0	0.91	2.55
WS5	0.0	1.9	18.9	0.0	0.0	0.88	3.10
WS8	0.0	2.8	17.3	0.0	0.0	0.76	0.85
WS9	0.0	1.4	19.4	0	0	1.14	2.87

Notes

L.E.L. Lower Explosive Limit (100% L.E.L.' = 5% Flammable Gas)
N.D. Not Detected
N.R. Not Recorded
% By Volume

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P6547

SITE. Island Road South, Garston, Liverpool

CLIENT. The Alan Johnston Partnership

DATE. 30-Jun-14

CONDITIONS. *WEATHER:* Sunny/Clear
ATMOSPHERIC PRESSURE: 1014 mb
PRESSURE TREND:

OPERATOR. David Evans

EQUIPMENT. LMXSi Gas Data Recorder

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE14 2WH

Telephone: (01283) 551 249

Facsimile: (01283) 211 968

Email: mail@grm-uk.com

RESULTS

Borehole/ Well Ref. No.	Methane (CH ₄) %v/v	Carbon Dioxide (CO ₂) %v/v	Oxygen (O ₂) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	8.5	9.6	0.0	0.0	2.98	3.13
WS3	0.0	8.6	6.5	0.0	0.0	1.58	3.10
WS4	0.0	2.9	19.3	0.0	0.0	0.95	2.55
WS5	0.0	3.1	17.9	0.0	0.0	1.07	3.10
WS8	0.0	3.5	16.3	0.0	0.0	DRY	0.78
WS9	0.0	7.1	13.8	0.0	0.0	1.31	2.84

Notes

L.E.L. Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
N.D. Not Detected
N.R. Not Recorded
% By Volume

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P6547

SITE. Island Road South, Garston, Liverpool

CLIENT. The Alan Johnston Partnership

DATE. 17-Jun-14

CONDITIONS. *WEATHER:* SUNNY
ATMOSPHERIC PRESSURE: 1024 mb
PRESSURE TREND:

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE14 2WH

Telephone: (01283) 551 249

Facsimile: (01283) 211 968

Email: mail@grm-uk.com

OPERATOR. STEPHEN MORRIS

EQUIPMENT. LMXSi Gas Data Recorder

RESULTS

Borehole/ Well Ref. No.	Methane (CH ₄) %v/v	Carbon Dioxide (CO ₂) %v/v	Oxygen (O ₂) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	7.2	11.3	0.0	0.0	2.95	3.1
WS3	0.0	5.9	13.0	0.0	0.0	1.62	3.10
WS4	0.0	1.6	18.9	0.0	0.0	0.95	2.60
WS5	0.0	1.9	18.8	0.0	0.0	0.92	3.10
WS8	0.0	2.8	17.1	0.0	0.0	DAMP	0.80
WS9	0.0	2.2	17.6	0.0	0.0	1.28	2.80

Notes

L.E.L. Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
N.D. Not Detected
N.R. Not Recorded
% By Volume

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P6547

SITE. Island Road South, Garston, Liverpool

CLIENT. The Alan Johnston Partnership

DATE. 20-Dec-12

CONDITIONS. *WEATHER:* SUNNY/OVERCAST
ATMOSPHERIC PRESSURE: 1006 mb
PRESSURE TREND:

OPERATOR. DAVID EVANS

EQUIPMENT. LMXSi Gas Data Recorder

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE14 2WH

Telephone: (01283) 551 249

Facsimile: (01283) 211 968

Email: mail@grm-uk.com

RESULTS

Borehole/ Well Ref. No.	Methane (CH ₄) %v/v	Carbon Dioxide (CO ₂) %v/v	Oxygen (O ₂) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	14.0	9.5	0.0	0.0	2.67	3.1
WS3	0.0	4.8	16.4	0.0	0.0	0.98	3.10
WS4	0.0	3.9	18.8	0.0	0.0	0.94	2.60
WS5	0.0	4.7	18.1	0.0	0.0	0.94	3.10
WS8	0.0	5.7	17.0	0.0	0.0	DRY	0.80
WS9	0.0	9.3	14.3	0.0	0.0	1.29	2.80

Notes

L.E.L. Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
N.D. Not Detected
N.R. Not Recorded
% By Volume