

GRM Development Solutions Ltd
Laurus House
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DE14 2WH

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Date: 7th January 2013
Our Ref: P5946 DWH1

Mr S Wright
David Wilson Homes (East Midlands),
Forest Business Park,
Cartwright Way
Bardon Hill
Coalville,
Leicestershire,
LE67 1GL.

Dear Steve,

Re: Ashlands Road, Sutton in Ashland.

The gas monitoring programme at the above site is now complete. The assessment below supersedes the information in GRM Site Appraisal report P5946/F1 dated December 2012 and should be submitted along with it to the regulatory bodies for approval.

Gas monitoring has been carried out to assess the risk posed to end users from harmful ground gases. 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 underfloor voids. For this site, as the method of ground floor construction is not yet known, the risk from ground gases has been assessed using 'Situation A' and 'Situation B'.

As the proposed land use is classed as high sensitivity (residential with gardens), ten gas/water monitoring standpipes have been installed across the site. The 35mm standpipes have been installed in window sampling boreholes. Due to the lack of significant made ground deposits on site, the response zones of the standpipes were targeted at the natural strata.

As the gas hazard is considered to be low, the monitoring programme comprised six visits over three months. The gas monitoring has been undertaken using an LMSxi Multifunction Gas Analyser. The results are enclosed for reference.

Whilst generally no flow was recorded during the monitoring program, on the last monitoring visit a flow rate of 2l/hr was recorded in WS6. This worst case flow rate has been used in the following assessment.

Situation A

Using the worst case borehole flow rate of 2l/hr and the maximum carbon dioxide concentration of 3.4% v/v a GSV of 0.068l/hr has been calculated for carbon dioxide. No elevated concentrations of methane have been recorded. Therefore, as the levels of methane and carbon dioxide are below 1% and 5% respectively, and the GSV is <0.07l/hr, the site has been assessed as 'Characteristic Situation 1' as outlined in table 8.5 of CIRIA C665.

Situation B

Using the worst case borehole flow rate of 2l/hr and the maximum carbon dioxide concentration of 3.4%v/v, a GSV of 0.068l/hr (<0.78l/hr) has been calculated for carbon dioxide. No elevated concentrations of methane have been recorded. Therefore, as the levels of methane and carbon dioxide are below 1% and 5% respectively the site has been assessed as traffic light 'Green' as outlined in table 8.7 of CIRIA C665.

Therefore, the results of the full gas monitoring programme are consistent with the initial findings of GRM's Site Appraisal (Ref: P5946/F.1, dated December 2012) and gas protection measures are not required to protect the proposed development against landfill type gases. Please note that **BASIC** Radon protection measures **are** required on the site.

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

Yours sincerely

Geoffrey Beckett C Geol
Senior Engineering Geologist

MONITORING OF SOIL GASES & GROUNDWATER



PROJECT NO. P5946

SITE. Sutton in Ashfield

CLIENT. David Wilson Homes

DATE. 1st November 2012

CONDITIONS. *WEATHER:* Overcast
ATMOSPHERIC PRESSURE: 992 mb

OPERATOR. AH

EQUIPMENT. LMXSi Gas Data Recorder

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Telephone: (01283) 551 249
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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) |
|-------------------------|--|--|-------------------------------|-------------|-------|------------------------------|---------------------|
| 1 | Borehole inaccessible due to surface water | | | | | | |
| 2 | Borehole inaccessible due to surface water | | | | | | |
| 3 | 0.0 | 0.9 | 18.1 | 0.0 | 0/0/0 | 2.58 | 3.14 |
| 4 | 0.0 | 1.0 | 19.3 | 0.0 | 0/0/0 | 1.89 | 3.12 |
| 5 | 0.0 | 0.5 | 19.2 | 0.0 | 0/0/0 | Dry | 3.07 |
| 6 | 0.0 | 0.3 | 18.6 | 0.0 | 0/0/0 | 2.75 | 3.19 |
| 7 | 0.0 | 0.4 | 18.4 | 0.0 | 0/0/0 | 0.90 | 2.31 |
| 8 | 0.0 | 0.6 | 19.4 | 0.0 | 0/0/0 | 1.43 | 3.15 |
| 9 | 0.0 | 0.0 | 21.1 | 0.0 | 0/0/0 | 0.73 | 3.07 |
| 10 | 0.0 | 1.3 | 18.4 | 0.0 | 0/0/0 | 1.12 | 2.93 |
| | | | | | | | |
| | | | | | | | |

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. P5946

SITE. Sutton in Ashfield

CLIENT. David Wilson Homes

DATE. 12-Nov-12

CONDITIONS. *WEATHER:* Raining
ATMOSPHERIC PRESSURE: 1009 mb

OPERATOR. AH

EQUIPMENT. LMXSi Gas Data Recorder

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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) |
|-------------------------|--|--|-------------------------------|-------------|-------|------------------------------|---------------------|
| 1 | 0.0 | 0.0 | 18.7 | 0.1 | 0.0 | | |
| 2 | Borehole inaccessible due to surface water | | | | | | |
| 3 | 0.0 | 3.4 | 14.9 | 0.0 | 0.0 | Dry | |
| 4 | Borehole inaccessible due to surface water | | | | | | |
| 5 | 0.0 | 2.3 | 18.4 | 0.0 | 0.0 | 1.25 | |
| 6 | 0.0 | 0.9 | 16.5 | 0.1 | 0.0 | | |
| 7 | 0.0 | 0.9 | 17.1 | 0.1 | 0.0 | Dry | |
| 8 | Borehole inaccessible due to surface water | | | | | | |
| 9 | 0.0 | 0.3 | 21.3 | -0.1 | 0.0 | 1.62 | |
| 10 | 0.0 | 2.3 | 18.4 | 0.1 | 0.0 | 1.40 | |
| | | | | | | | |
| | | | | | | | |

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. P5946

SITE. Sutton in Ashfield

CLIENT. David Wilson Homes

DATE. 26th November 2012

CONDITIONS. *WEATHER:* Foggy and overcast
ATMOSPHERIC PRESSURE: 983 mb

OPERATOR. PT

EQUIPMENT. LMXSi Gas Data Recorder

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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) |
|----------------------------|--|---|----------------------------------|-------------|-------|------------------------------------|------------------------|
| 1 | Borehole inaccessible due to surface water | | | | | | |
| 2 | Borehole inaccessible due to surface water | | | | | | |
| 3 | Borehole inaccessible due to surface water | | | | | | |
| 4 | Borehole inaccessible due to surface water | | | | | | |
| 5 | 0.0 | 1.2 | 19.1 | 0.0 | 0.0 | 0.73 | 3.07 |
| 6 | Borehole inaccessible due to surface water | | | | | | |
| 7 | Borehole inaccessible due to surface water | | | | | | |
| 8 | Borehole inaccessible due to surface water | | | | | | |
| 9 | 0.0 | 0.0 | 21.4 | 0.0 | 0.0 | 0.86 | 3.07 |
| 10 | Borehole inaccessible due to surface water | | | | | | |
| | | | | | | | |
| | | | | | | | |

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. P5946

SITE. Sutton in Ashfield

CLIENT. David Wilson Homes

DATE. 12-Dec-12

CONDITIONS. *WEATHER:* Foggy / overcast
ATMOSPHERIC PRESSURE: 1007 mb

OPERATOR. PJTT

EQUIPMENT. LMXSi Gas Data Recorder

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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) |
|-------------------------|---------------------------------------|--|-------------------------------|-------------|-------|------------------------------|---------------------|
| 1 | 0.0 | 0.1 | 18.4 | 0.0 | 0.0 | 2.25 | 3.01 |
| 2 | Under ice | | | | | | |
| 3 | Under water (could break through ice) | | | | | | |
| 4 | 0.0 | 0.1 | 19.1 | 0.0 | 0.0 | 0.00 | 3.10 |
| 5 | 0.0 | 0.2 | 19.2 | 0.0 | 0.0 | 1.28 | 2.40 |
| 6 | Lid frozen shut | | | | | | |
| 7 | 0.0 | 0.0 | 18.8 | 0.0 | 0.0 | 2.00 | 3.06 |
| 8 | 0.0 | 0.0 | 18.9 | 0.0 | 0.0 | 1.54 | 3.14 |
| 9 | 0.0 | 0.0 | 19.0 | 0.0 | 0.0 | 0.54 | 2.97 |
| 10 | Tap missing (bung in place) | | | | | 0.00 | 2.97 |
| | | | | | | | |
| | | | | | | | |

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. P5946

SITE. Sutton in Ashfield

CLIENT. David Wilson Homes

DATE. 19-Dec-12

CONDITIONS. *WEATHER:* Cloudy
ATMOSPHERIC PRESSURE: 1002

OPERATOR. PJTT

EQUIPMENT. LMXSi Gas Data Recorder

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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) |
|----------------------------|------------------------------------|---|----------------------------------|-------------|-------|------------------------------------|------------------------|
| 1 | Underwater | | | | | | |
| 2 | Underwater | | | | | | |
| 3 | 0.0 | 3.1 | 9.6 | 0.0 | 0.0 | 1.95 | 3.19 |
| 4 | Underwater | | | | | | |
| 5 | 0.0 | 1.1 | 20.1 | -0.6 | 0.0 | 0.99 | 2.49 |
| 6 | 0.0 | 0.5 | 18.2 | 0.0 | 0.0 | 1.68 | 3.15 |
| 7 | 0.0 | 1.2 | 14.8 | -1.4 | 0.0 | 1.98 | 3.15 |
| 8 | 0.0 | 0.8 | 20.4 | 0.0 | 0.0 | 1.43 | 3.17 |
| 9 | 0.0 | 0.5 | 21.2 | 0.0 | 0.0 | 1.80 | 3.10 |
| 10 | 0.0 | 0.0 | 21.4 | 0.0 | 0.0 | 0.20 | 3.01 |
| | | | | | | | |
| | | | | | | | |

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. P5946

SITE. Sutton in Ashfield

CLIENT. David Wilson Homes

DATE. 03-Jan-13

CONDITIONS. *WEATHER:*
ATMOSPHERIC PRESSURE: 1014mb

OPERATOR. AH

EQUIPMENT. LMXSi Gas Data Recorder

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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) |
|----------------------------|------------------------------------|---|----------------------------------|-------------|-------|------------------------------------|------------------------|
| 1 | Waterlogged | | | | | | |
| 2 | Waterlogged | | | | | | |
| 3 | 0.0 | 3.0 | 9.0 | -0.1 | 0.0 | 1.77 | 3.10 |
| 4 | Waterlogged | | | | | | |
| 5 | 0.0 | 0.9 | 20.3 | 0.0 | 0.0 | 1.45 | 2.88 |
| 6 | 0.0 | 2.2 | 5.5 | 2.0 | 0.0 | 1.80 | 3.30 |
| 7 | 0.0 | 0.4 | 20.2 | -0.3 | 0.0 | 1.52 | 3.00 |
| 8 | 0.0 | 0.9 | 15.1 | 0.1 | 0.0 | 1.24 | 3.00 |
| 9 | 0.0 | 0.3 | 20.9 | -0.2 | 0.0 | 1.65 | 3.95 |
| 10 | Tap Missing | | | | | 0.87 | 3.94 |
| | | | | | | | |
| | | | | | | | |

Notes

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