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Our Ref: P7298\GAL

Date: 26th July 2016

Catesby Estates Ltd
Via email only

Attention of Rebecca Birch

Dear Rebecca,

Re: Gas Addendum Letter for Land to the north east of Glebelands, Pulborough

The gas monitoring programme at the above site is now complete. The assessment below supersedes the information in the Site Appraisal Report (GRM/P7298/F.1 dated: April 2016) and should be submitted to the regulatory bodies for approval.

The Phase I desk study and ground investigation did not identify a significant source of ground gas; however, as the groundwater level required monitoring and to confirm potential liabilities, gas monitoring was undertaken.

As the proposed end use has been classified as high sensitivity (residential with gardens), seven gas/water monitoring standpipes have been installed across the site (WS1-WS7) and targeted at the natural strata (very low generation potential). See Phase II report for assessment.

To confirm potential liabilities, gas monitoring has been carried out fortnightly over a 2 month period from 17th March to 25th May 2016, to assess the risk posed to the end user from potentially harmful ground gases.

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)
WS1 (6)	0.8-1.8m / NAT	None	0-0	0.9-3.4	14.9-17.6	0.00
WS2 (6)	1-3m / NAT	None	0-0	0.4-3.5	15.6-20	0.00
WS3 (6)	0.5-1m / NAT	None	0-0	4.0-7.0	7.7-13.9	0.00
WS4 (6)	1-2m / NAT	None	0-0	2.3-5.6	15.7-17	0.00
WS5 (6)	1-2m / NAT	None	0-0	1.4-4.2	11.6-16.5	0.00
WS6 (6)	1-2m / NAT	None	0-0	0.0-4.0	14.8-20.3	0.00
WS7 (6)	1-3m / NAT	None	0-0	0.0-4.6	10.1-19.9	0.00
Notes: NAT= Natural Strata, Atmospheric Pressure: 994mb-1027mb						

Groundwater

The monitoring program has confirmed the general absence of shallow groundwater beneath the site, in particular window sample boreholes WS2, WS4, WS6 and WS7 did not record any groundwater during the monitoring period.

It is considered unlikely that dewatering will be required for shallow short-term excavations. However for deeper excavations into the rock simple dewatering techniques (e.g. sump pumping) may be needed to control water ingress. This concurs with the findings of the Phase II report.

Ground Gas Risk Assessment

The primary guidance document to determine if gas protection measures are required is BS8485:2015. This uses hazardous gas flow rates (Qhg), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Screening Value (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors including gas concentrations and flow rates.

Methane concentrations and flow rates above the monitor's lower limits of detection were not detected during monitoring period. Therefore, in the following assessment a default methane concentration of 0.1% v/v and a default flow rate of 0.1l/hr has been used.

Using the default methane concentration of 0.1%v/v and the default flow rate of 0.1l/hr a Qhg of 0.0001l/hr has been calculated for methane. Using the maximum recorded steady state carbon dioxide concentration of 7%v/v and the default flow rate of 0.1l/hr a Qhg of 0.007l/hr has been calculated for carbon dioxide. On this basis the GSV for the site is determined as 0.007l/hr

Although the GSV is less than 0.07l/hr, concentrations of carbon dioxide have been recorded in excess of 5%v/v and as such, further consideration has been given to the most appropriate Characteristic Situation.

GRM's detailed logging of the soils encountered at the site has not revealed any high ground gas potential source, such as timber, paper, refuse etc. On this basis, taking into account the low number of readings over 5% for carbon dioxide (5/42), the low flow rates and absence of significant sources of ground gas, a Characteristic Situation of CS1 is considered to be appropriate for the site.

It is recommended that this assessment is confirmed with the local authority as soon as possible so that abnormal costs can be better identified.

If you would like us to undertake this on your behalf, then please provide contact details and a Planning Reference.

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,

[redacted] Solutions Ltd

Senior Engineering Geologist

Enc:
P7298 Gas Monitoring Location Plan
P7298 Gas Monitoring Results

In-Situ Gas Monitoring Results

Project Name:	Land off Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	17 March 2016
Weather:	Dry
Atmospheric Pressure (mb):	1024
Pressure Trend:	Steady
Equipment:	Gas Data GFM430
Operator:	Tony Heron

Ground Gases														Groundwater	
Well ID	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		
WS1	0.8	1.8	NAT	0.00	0.00	0.90	0.90	14.90	14.90	0.00	0.00	N/R	N/R	N/D	2.00
WS2	1.0	3.0	NAT	0.00	0.00	1.00	1.00	19.50	19.50	0.00	0.00	N/R	N/R	N/D	3.36
WS3	0.5	1.0	NAT	0.00	0.00	4.50	4.50	7.70	7.70	0.00	0.00	N/R	N/R	N/D	1.30
WS4	1.0	2.0	NAT	0.00	0.00	2.30	2.30	17.00	17.00	0.00	0.00	N/R	N/R	N/D	1.89
WS5	1.0	2.0	NAT	0.00	0.00	1.40	1.40	16.50	16.50	0.00	0.00	N/R	N/R	1.67	2.13
WS6	1.0	2.0	NAT	0.00	0.00	1.70	1.70	16.20	16.20	0.00	0.00	N/R	N/R	N/D	2.09
WS7	1.0	3.0	NAT	0.00	0.00	0.00	0.00	19.90	19.90	0.00	0.00	N/R	N/R	N/D	2.60

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 Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	01 April 2016
Weather:	Dry
Atmospheric Pressure (mb):	1015
Pressure Trend:	Falling
Equipment:	Gas Data GFM430
Operator:	Tony Heron

Ground Gases														Groundwater	
Well ID	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		
WS1	0.8	1.8	NAT	0.00	0.00	1.40	1.40	15.10	15.10	0.00	0.00	N/R	N/R	1.60	2.10
WS2	1.0	3.0	NAT	0.00	0.00	0.40	0.40	20.00	20.00	0.00	0.00	N/R	N/R	N/D	3.37
WS3	0.5	1.0	NAT	0.00	0.00	5.00	5.00	9.50	9.50	0.00	0.00	N/R	N/R	N/D	1.29
WS4	1.0	2.0	NAT	0.00	0.00	3.50	3.50	16.60	16.60	0.00	0.00	N/R	N/R	N/D	1.90
WS5	1.0	2.0	NAT	0.00	0.00	2.30	2.30	12.80	12.80	0.00	0.00	N/R	N/R	1.77	2.14
WS6	1.0	2.0	NAT	0.00	0.00	2.30	2.30	15.70	15.70	0.00	0.00	N/R	N/R	N/D	2.10
WS7	1.0	3.0	NAT	0.00	0.00	2.10	2.10	18.30	18.30	0.00	0.00	N/R	N/R	N/D	2.69

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 Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	15 April 2016
Weather:	Rain
Atmospheric Pressure (mb):	994
Pressure Trend:	Falling
Equipment:	Gas Data LMSXi
Operator:	Liam Press

Ground Gases														Groundwater	
Well ID	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		
WS1	0.8	1.8	NAT	0.00	0.00	1.80	1.80	16.80	16.80	0.00	0.00	N/R	N/R	N/D	2.10
WS2	1.0	3.0	NAT	0.00	0.00	2.70	2.70	16.50	16.50	0.00	0.00	N/R	N/R	N/D	3.37
WS3	0.5	1.0	NAT	0.00	0.00	4.00	4.00	12.70	12.70	0.00	0.00	N/R	N/R	1.11	1.29
WS4	1.0	2.0	NAT	0.00	0.00	3.00	3.00	16.10	16.10	0.00	0.00	N/R	N/R	N/D	1.90
WS5	1.0	2.0	NAT	0.00	0.00	2.60	2.60	13.20	13.20	0.00	0.00	N/R	N/R	1.83	2.14
WS6	1.0	2.0	NAT	0.00	0.00	2.40	2.40	14.80	14.80	0.00	0.00	N/R	N/R	N/D	2.10
WS7	1.0	3.0	NAT	0.00	0.00	3.80	3.80	11.60	11.60	0.00	0.00	N/R	N/R	N/D	2.69

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 Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	04 May 2016
Weather:	Dry
Atmospheric Pressure (mb):	1027
Pressure Trend:	Falling
Equipment:	Gas Data LMSXi
Operator:	Phil Devitt

Ground Gases														Groundwater	
Well ID	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		
WS1	0.8	1.8	NAT	0.00	0.00	3.30	3.30	17.60	17.60	0.00	0.00	N/R	N/R	N/D	2.10
WS2	1.0	3.0	NAT	0.00	0.00	3.50	3.50	15.60	15.60	0.00	0.00	N/R	N/R	N/D	3.37
WS3	0.5	1.0	NAT	0.00	0.00	7.00	7.00	13.40	13.40	0.00	0.00	N/R	N/R	N/D	1.29
WS4	1.0	2.0	NAT	0.00	0.00	5.60	5.60	15.70	15.70	0.00	0.00	N/R	N/R	N/D	1.90
WS5	1.0	2.0	NAT	0.00	0.00	4.20	4.20	11.60	11.60	0.00	0.00	N/R	N/R	1.95	2.14
WS6	1.0	2.0	NAT	0.00	0.00	4.00	4.00	17.10	17.10	0.00	0.00	N/R	N/R	N/D	2.10
WS7	1.0	3.0	NAT	0.00	0.00	4.30	4.30	10.10	10.10	0.00	0.00	N/R	N/R	N/D	2.69

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 Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	10 May 2016
Weather:	Dry
Atmospheric Pressure (mb):	1006
Pressure Trend:	Rising
Equipment:	Gas Data GFM430
Operator:	Tom Robson

Ground Gases														Groundwater	
Well ID	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		
WS1	0.8	1.8	NAT	0.00	0.00	3.20	3.20	16.20	16.20	0.00	0.00	N/R	N/R	N/D	2.09
WS2	1.0	3.0	NAT	0.00	0.00	0.80	0.80	19.70	19.70	0.00	0.00	N/R	N/R	N/D	3.35
WS3	0.5	1.0	NAT	0.00	0.00	5.80	5.80	13.70	13.70	0.00	0.00	N/R	N/R	1.10	1.26
WS4	1.0	2.0	NAT	0.00	0.00	3.20	3.20	16.80	16.80	0.00	0.00	N/R	N/R	N/D	1.88
WS5	1.0	2.0	NAT	0.00	0.00	3.50	3.50	12.80	12.80	0.00	0.00	N/R	N/R	N/D	2.12
WS6	1.0	2.0	NAT	0.00	0.00	2.50	2.50	15.50	15.50	0.00	0.00	N/R	N/R	N/D	2.09
WS7	1.0	3.0	NAT	0.00	0.00	4.60	4.60	10.30	10.30	0.00	0.00	N/R	N/R	N/D	2.16

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 Drovers lane, Pulborough
Project Number:	P7298
Client:	Catesby Properties
Date:	25 May 2016
Weather:	Dry
Atmospheric Pressure (mb):	1015
Pressure Trend:	Rising
Equipment:	Gas Data GFM430
Operator:	Tom Robson

Ground Gases														Groundwater	
Well ID	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		
WS1	0.8	1.8	NAT	0.00	0.00	3.40	3.40	16.80	16.80	0.00	0.00	N/R	N/R	N/D	2.10
WS2	1.0	3.0	NAT	0.00	0.00	1.20	1.20	19.50	19.50	0.00	0.00	N/R	N/R	N/D	3.35
WS3	0.5	1.0	NAT	0.00	0.00	6.40	6.40	13.90	13.90	0.00	0.00	N/R	N/R	N/D	1.27
WS4	1.0	2.0	NAT	0.00	0.00	3.80	3.80	16.50	16.50	0.00	0.00	N/R	N/R	N/D	1.88
WS5	1.0	2.0	NAT	0.00	0.00	4.00	4.00	13.60	13.60	0.00	0.00	N/R	N/R	N/D	2.12
WS6	1.0	2.0	NAT	0.00	0.00	0.00	0.00	20.30	20.30	0.00	0.00	N/R	N/R	N/D	2.07
WS7	1.0	3.0	NAT	0.00	0.00	1.70	1.70	18.30	18.30	0.00	0.00	N/R	N/R	N/D	2.66

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