

Foreman Homes Ltd.
Brockhampton Holdings Ltd.
Portsmouth Water Ltd.
Brockhampton Property Investments Ltd.

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Via email only: Neil.Calderwood@foremanhomes.co.uk

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Our Ref.: 17877/SGLR

Dear Neil

Re: Kingscroft Farm, Ranelagh Road, Havant, Hampshire PO9 1FJ

Foreman Homes Ltd., Brockhampton Holdings Ltd., Portsmouth Water Ltd. and Brockhampton Property Investments Ltd. commissioned Soils Limited to undertake a Soil-Gas Risk Assessment at the site referred to as Kingscroft Farm, Ranelagh Road, Havant, Hampshire PO9 1FJ.

This letter report must be read in conjunction with the following documents:

Preliminary Investigation Report (Soils Limited report ref.: 17877/PIR_R26, dated November 2019)

Main Investigation Report (Soils Limited report ref.: 17877/MIR_R27, dated November 2019)

Background

The Preliminary Investigation Report (PIR) undertaken on the site identified a low to moderate risk of soil gas onsite associated with offsite sources.

The site was situated within an area where protection or risk assessment against the ingress of radon was required. The site location within an area of 1km grid square were in bands of elevated radon potential. Maximum radon potential was 3-5%.

Radon protection measures are typically only required when the radon potential is 5-10% and therefore it is possible that radon protection measures will not be required as part of the proposed development, however, consultation with the local Building Control department at the Local Authority is recommended as they will be able to advise on whether or not radon protection measures are required in new developments within the



site's vicinity. It is not possible in the course of a survey or inspection to determine whether radon gas is present as the gas is colourless and odourless. Tests can be undertaken to assess the concentration of radon in existing structures.

To quantify the risk posed to the site from the identified sources, a soil gas risk assessment was recommended. This comprised six soil gas monitoring visits undertaken over a period of approximately three months.

Gas Monitoring Records

Soil gas monitoring standpipes were installed in WS1, WS2 and WS4 each to a depth of 4.00m bgl. The locations were selected to provide a general coverage of the site as appropriate to the identified offsite sources.

Monitoring of the standpipes were undertaken on six occasions between 22nd October 2019 and 31st December 2019, targeting periods of low and falling atmospheric pressure where possible.

The concentration of methane (both total and LEL), hydrogen sulphide, carbon monoxide, carbon dioxide and oxygen were measured using a portable infrared monitor. Readings of flowrate were taken with a differential manometer calibrated to give flow rate. A Photo Ionisation Detector (PID) was used to detect for Volatile Organic Compounds (VOCs). The results of the monitoring are provided in Table 1.

Table 1. Soil Gas Monitoring Results

Date (Baro Trend)	Trial Hole	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	H ₂ S (ppm)	CO (ppm)	LEL (%)	aP (mb)	Flow (l/h)	VOC (ppm)	H ₂ O (m bgl)	Base of hole
22/10/2019 (Steady)	ATM	0.0	0.0	21.0	0.0	0.0	0.0	1022	0.0	0.0	-	-
	WS1	0.0	1.3	19.4	0.0	0.0	0.0	1022	0.0	0.0	DRY	3.80
	WS2	0.0	2.7	14.8	0.0	0.0	0.0	1022	0.0	0.0	DRY	3.61
	WS4	0.0	1.0	20.0	0.0	0.0	0.0	1022	0.0	0.0	DRY	3.86
07/11/2019 (Steady)	ATM	0.0	0.0	21.3	0.0	0.0	0.0	995	0.0	0.0	-	-
	WS1	0.0	2.5	16.8	0.0	0.0	0.0	995	0.0	0.0	2.36	3.78
	WS2	0.0	2.6	16.6	0.0	0.0	0.0	995	0.0	0.0	2.56	3.59
	WS4	0.0	0.0	20.7	0.0	0.0	0.0	995	0.0	0.0	3.72	3.85
19/11/2019 (Steady)	ATM	0.0	0.0	21.3	0.0	0.0	0.0	1016	0.0	0.0	-	-
	WS1	0.0	2.2	19.1	0.0	0.0	0.0	1016	0.0	0.0	2.36	3.77
	WS2	0.0	3.3	14.3	0.0	0.0	0.0	1016	0.0	0.0	2.68	3.54
	WS4	0.0	3.8	9.5	0.0	0.0	0.0	1016	0.0	0.0	DRY	3.82
05/12/2019 (Falling)	ATM	0.0	0.0	19.9	0.0	0.0	0.0	1020	0.0	0.0	-	-
	WS1	0.0	1.5	18.0	0.0	0.0	0.0	1020	0.0	0.0	DRY	3.80
	WS2	0.0	0.0	19.9	0.0	0.0	0.0	1020	0.0	0.0	2.67	3.56
	WS4	0.0	2.5	8.1	0.0	0.0	0.0	1019	0.0	0.0	3.81	3.83
16/12/2019 (Rising)	ATM	0.0	0.0	19.9	0.0	0.0	0.0	999	0.0	0.0	-	-
	WS1	0.0	0.7	18.9	0.0	0.0	0.0	999	0.1	0.0	1.99	3.75
	WS2	0.0	2.5	11.6	0.0	0.0	0.0	999	0.0	0.0	2.37	3.53
	WS4	0.0	2.1	10.6	0.0	0.0	0.0	999	0.0	0.0	3.50	3.84
31/12/2019 (Steady)	ATM	0.0	0.0	19.8	0.0	0.0	0.0	1030	0.0	0.0	-	-
	WS1	0.0	2.0	12.5	0.0	0.0	0.0	1030	0.0	0.0	2.17	3.78
	WS2	0.0	2.9	10.5	0.0	0.0	0.0	1030	0.0	0.0	2.51	3.52
	WS4	0.0	2.2	8.9	0.0	0.0	0.0	1030	0.0	0.0	3.64	3.84

Notes: Zero reading = below the equipment detection limit. Published barometric pressure trend data obtained for each monitoring visit from Southampton Airport Weather Station.

The monitoring undertaken detected the presence of carbon dioxide at concentrations of between <0.1% and 3.8% v/v and oxygen at concentrations between 8.1% and 20.7% v/v within the monitoring wells.

No concentrations of methane (total or LEL), hydrogen sulphide, carbon monoxide or VOCs were recorded above instrument detection levels, atmospheric pressure was recorded between 995 and 1030mb and no positive gas flow rates were recorded during the monitoring period.

Data Quality

A review was made of the quality of the available data for the site, which can be viewed in Table 2. CIRIA 665 (2007) and BS 8485:2015 stress the need for risk assessments to be based on good quality data and give guidance as to best practice in this respect.

Table 2 – Review of Data Quality

Data Type	Current Situation	UK Practice
Geological and hydro-geological conditions	With regard to soil gas risk assessment the data collected from the intrusive investigation was considered to be good.	CIRIA 665, Wilson and Card (1999) and BS 8485:2015 recommend that geology and hydrogeology be fully understood.
Monitoring period	Monitoring has been undertaken on a total of six occasions over an approximate period of approximately three months. Monitoring has been undertaken over a range of seasons and weather conditions including falling-rising and low and high atmospheric pressures.	CIRIA 665 recommends approximately 9 to 12 monitoring visits over approximately 6 months residential development with development with low to moderate soil gas generation potential of identified sources. Wilson and Card (1999) recommend that for less than 12 months monitoring the protective measures should be made more conservative.
Gas data sets	Borehole flow velocity has been measured on each monitoring occasion.	Borehole flow velocity and borehole gas volume required to define characteristic gas saturation. Modified Wilson and Card, Table 8.5 of CIRIA 665 (2006)/Table 2 of BS 8485:2015.

Data quality was considered good, covering a range of atmospheric pressure trends including readings taken during falling pressure and a low-pressure event (<1000mb), known as worst case conditions. Geological and hydrogeological conditions have been investigated as indicated in previous reports relating to this site. The dataset gained is considered sufficient to characterise the sites gassing regime and no further soil gas monitoring is deemed necessary.

Risk Assessment

Based on the documentation presented in the “BS 8485:2015, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings” the hazardous gas flow rate (Q_{hg}) was calculated using Equation 1:

$$Q_{hg} = (C_{hg}/100) * q \quad \text{Equation 1}$$

Where:

C_{hg} is the measured hazardous gas concentration in percentage volume-by-volume.

q is the flow rate in litres per hour of combined gases found by direct measurement.

If soil gas borehole flow was not detectable, it should be assumed to be at the detection limit of the equipment used, which was 0.1l/hr.

Consequently, the Q_{hg} for carbon dioxide was calculated using Equation 2.

$$\begin{aligned} Q_{hg} \text{ (l/hr)} &= \text{gas concentration} * \text{borehole flow rate (l/hr)} && \text{Equation 2} \\ &= 3.8/100 * 0.1 = \mathbf{0.0038 \text{ l/h}} \end{aligned}$$

The maximum carbon dioxide concentration was taken as the gas concentration as a percentage and the instrument detection limit was taken as the maximum for the borehole flow rate (0.1l/h) as no positive flow was recorded, thus increasing the degree of conservatism adopted.

Based on the Site Characteristic hazardous gas flow rate of 0.0038l/h, the site falls into Characteristic Gas Situation 1 (CS1), which does not require gas protection measures to be emplaced in accordance with BS 8485:2015.

Groundwater Monitoring

At the time of the intrusive investigation (October 2019), groundwater was recorded during the excavation of one trial hole (TP2) struck at a depth of 3.50m bgl within the River Terrace Deposits.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in October (2019), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September to the annual maximum (highest) which typically occurs around March.

Post-works groundwater monitoring was undertaken simultaneously with the soil gas readings comprising six readings from the standpipes installed onsite (WS1, WS2 and WS4) between 22nd October 2019 and 31st December 2019, and results tabulated in Table 1.

The post-works groundwater monitoring recorded water levels within the standpipes at a highest elevation of 1.99m bgl.

Conclusion

A review of the soil gas monitoring undertaken on the site indicated the sites gasping regime to be representative of CS1 under BS 8485:2015 based on the hazardous gas concentration of carbon dioxide screening values, indicating that gas protection measures are not required for the site.

Should you have any queries regarding the above, please do not hesitate to contact the undersigned.

Yours sincerely



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For and on behalf of Soils Limited.