Quayside 40-58 Hotwell Road Bristol BS8 4UQ T. 0117 302 7560 bristol@curtins.com www.curtins.com



Our reference: EB1824A/GB/6334

3 February 2016

Fusion Students 1<sup>st</sup> Floor 506 Centennial Park ELSTREE WD6 3FG

To Whom It May Concern

## Re: Phase 2 Gas Monitoring

Further to the issue of our Phase 2 Intrusive Investigation Report document reference no. EB1824A/GB/6101 Dec 2015 for the above site, we submit herein our addendum gas monitoring report which is to be read in conjunction with the aforementioned document.

## Monitoring

Gas monitoring pipework was installed within boreholes BH1, BH2, WS1, WS3 and WS4. to assess if there are any risks from ground gas.

Gas monitoring has been undertaken across the site on six occasions between 6.11.15 and 13.1.16.

During the visits barometric pressure was recorded between 977 and 1025 millibars.

# Carbon Dioxide

Levels of carbon dioxide varied between 0.3% and 5.3%  $^{\rm V}\!/_{\rm V}$  with a maximum gas flow rate of 0.1l/hr.

The highest readings were recorded within borehole BH2 and WS3.

Based on the flow rate of 0.1/hr and the highest recorded carbon dioxide concentration of 5.3%, a maximum gas screening value (GSV) of 0.0053/hr is calculated, as follows:  $(5.3/100) \times 0.1 = 0.0053$ l/hr.

### Methane

Methane was found to vary between undetectable and  $0.1\%^{V/V}$  with a maximum gas flow rate of 0.11/hr.

Based on the flow rate limit of 0.1l/hr and the highest recorded methane concentration of 0.1%, a gas screening value of 0.0001l/hr is calculated as follows:  $(0.1/100) \times 0.1 = 0.0001$ l/hr.



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# Conclusions

With reference to Situation A non-traditional construction as defined by the NHBC and the modified Wilson & Card classification as contained within CIRIA C665, given that the maximum carbon dioxide level exceeds the maximum recommended concentration of 5% it is considered that gas protection should be incorporated into the development in accordance with 'gas characteristic situation 2'.

The results of the gas monitoring can be referred to below.

If you require any further advice please do not hesitate to contact us.

Yours sincerely

Graham Behrens Principal Engineer For and on behalf of **Curtins Consulting Ltd** 

Enc: Gas Monitoring Results

Geo	•							_												
technic	D			Date of	f Visit	06/11	/2015													
al & Environm	IAI			CH <sub>4</sub> %	∕ov/v	CO <sub>2</sub>	%v/v	O <sub>2</sub> 0	∕ov/v	H <sub>2</sub> S	ppm	CO	ppm	VOC	ppm					
ironme	IAN FARMER	Backgroun	d Readings:	<0	.1	0	.1	2	1.0	<	0.1	<	0.1	Ν	R					
ntal Spec	ARM	8	8		Weat	her Conditi	ons		Overcast											
cialists	TES				Ground Cor				Wet											
					Atmosph	eric Pressu	re (mb)		1003											
Rama	Gas and	Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕o v/v	H <sub>2</sub> S	ррт	CO	ppm	VOC	C ppm	Water Level	Depth of Well	Water Sample Y
da H			()	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
Ramada Hotel, St Albans Road West, Hatfield AL10 9RH	Groundwater	BH1	15:05	1003	<0.1	<0.1	<0.1	1.7	1.7	19.2	19.2	<0.1	<0.1	1.0	1.0	NR	NR	5.16	5.91	N
Albar	dwate	BH2	15:21	1005	<0.1	<0.1	<0.1	1.5	1.5	18.7	18.7	<0.1	<0.1	<0.1	<0.1	NR	NR	8.95	9.72	N
ıs Ro	r Mo	WS1	15:30	1004	<0.1	<0.1	<0.1	2.8	2.8	17.4	17.4	<0.1	<0.1	<0.1	<0.1	NR	NR	DRY	1.09	N
ad We	nitor	WS3	15:17	1004	<0.1	< 0.1	<0.1	2.5	2.5	17.7	17.7	<0.1	<0.1	<0.1	<0.1	NR	NR	1.82	1.91	Ν
est, Ha	<b>Monitoring Results</b>	WS4	15:12	1003	<0.1	<0.1	<0.1	3.0	3.0	16.9	16.9	<0.1	<0.1	<0.1	<0.1	NR	NR	DRY	2.04	N
tfield /	esults																			
AL10																				
9RH																				
Figure No:	Job No:																			
0:																				
Α	S							NI	) = Below d	etection lin	nit of instru	ment. NR =	= Not Read.							
A2.12	52406	Readings	s Taken By:		LH							Checked	l By:	DA						

Geot	•																			
echnic				Date of	f Visit	20/11	/2015													
al & Env	IAI			CH <sub>4</sub> 9	∕₀v/v	CO <sub>2</sub>	%v/v	O <sub>2</sub> 0	∕ov/v	H <sub>2</sub> S	ppm	CO	ppm	VOC	ppm					
al & Environme	VF	Backgroun	nd Readings:	<0	.1	0	.1	2	1.3	<	0.1	<	0.1	Ň	R					
ntal Spe	ARA		<u>-</u>		Weat	her Conditi	ons		Overcast	t										
ecialists	IAN FARMER				Ground Cor	nditions (dr	y/wet etc.)		Wet											
					Atmosph	eric Pressu	re (mb)		999										•	•
Rama	Gas a	Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕o v/v	H <sub>2</sub> S	ррт	CO	ррт	VOC	Сррт	Water Level	Depth of Well	Water Sample Y
da H	and (		(111.1111)	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
Ramada Hotel, St Albans Road West, Hatfield AL10 9RH	Groundwater	BH1	15:30	999	<0.1	<0.1	<0.1	4.1	4.1	19.2	19.2	0	<0.1	<0.1	<0.1	0.1	<0.1	5.08	5.85	N
Albar	dwate	WS1	15:35	999	<0.1	<0.1	<0.1	3.9	3.9	18.7	18.7	0	<0.1	<0.1	<0.1	<0.1	<0.1	DRY	1.05	N
ıs Roa	r Moi	WS3	15:25	999	<0.1	<0.1	<0.1	5.2	5.2	17.7	17.7	0	<0.1	<0.1	<0.1	0.1	<0.1	1.70	1.90	N
id Wes	Monitoring	WS4	15:20	999	<0.1	<0.1	<0.1	3.6	3.6	16.9	16.9	0	<0.1	<0.1	<0.1	0.1	<0.1	1.90	1.99	N
st, Hat	ng Re																			
field	Results																			
AL10																				
9RH																				
Figu	Job No:																			
Figure No:	No:																			
A								NI	) = Below d	etection lin	nit of instru	ment. NR :	= Not Read							
A2.12 cont'd	52406	Readings	s Taken By:		LH							Checked		WC	G					
:ont'd	9(																			

Geo	•																			
technic	Ð			Date of	f Visit	24/11	/2015													
al & Env	IAI			CH <sub>4</sub> %	∕ov/v	CO <sub>2</sub>	%v/v	O <sub>2</sub> 0	∕₀v/v	H <sub>2</sub> S	ppm	CO	ppm	VOC	C ppm					
ironme	V F	Backgroun	d Readings:	<0.	.1	0	.1	2	1.3	<	0.1	<	).1	Ν	R					
ntal Spe	ARM	8	8		Weat	her Conditi	ons		Overcast	t										
cialists	IAN FARMER ASSOCIATES				Ground Cor				Damp											
					Atmosph	eric Pressu	re (mb)	l.	1004			l.								1
Rama	Gas and	Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕o v/v	H <sub>2</sub> S	ррт	CO	ppm	voo	c ppm	Water Level	Depth of Well	Water Sample Y
da Ho	nd C		()	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
Ramada Hotel, St Albans Road West, Hatfield AL10 9RH	<b>Groundwater Monitoring Results</b>	BH2	16:30	1004	<0.1	<0.1	<0.1	4.2	4.2	16.8	16.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	8.92	9.64	Y
t Alb:	dwat																			
ans R	er M																			
oad V	lonito																			
Vest,	oring																			
Hatfi	Res																			
eld A	ults																			
L10																				
9RH																				
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Figure No:	Job No:				1		1		1	1			1		I	1	1	1		1
A2.1	5							NI	) = Below d	etection lin	nit of instru									
A2.12 cont'd	52406	Readings	s Taken By:		MO	J						Checked	l By:	WG	G					
nt'd																				

Geot	•																			
technica	D			Date of	f Visit	09/12	2/2015													
al & Envi	IAN			CH <sub>4</sub> %	∕ov/v	CO <sub>2</sub>	%v/v	O <sub>2</sub> <sup>0</sup>	%v/v	H <sub>2</sub> S	ppm	CO	ppm	VOC	ppm					
ronmer	IAN FARMEI	Backgroun	d Readings:	<0	.1	<	0.1	2	1.3	<	0.1	<	).1	<	).1					
ital Spe	ARM		0		Weat	her Conditi	ons		Sunny, c	old										
cialists	ER				Ground Cor				Wet											
					Atmosph	eric Pressu	re (mb)		1025									1	1	
Rama	Gas a	Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕o v/v	H <sub>2</sub> S	ррт	CO	ppm	VOC	C ppm	Water Level	Depth of Well	Water Sample Y
da H	and C		()	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
Ramada Hotel, St Albans Road West, Hatfield AL10 9RH	Groundwater	BH1	14:35	1025	<0.1	<0.1	<0.1	1.2	1.2	20.9	20.9	<0.1	<0.1	1.0	1.0	NR	NR	4.99	5.72	Y
Albai	lwate	BH2	14:45	1024	<0.1	<0.1	<0.1	0.3	0.3	20.6	20.6	<0.1	<0.1	<0.1	<0.1	NR	NR	8.94	9.76	Y
ns Roa	r Mon	WS1	14:55	1024	<0.1	<0.1	<0.1	2.3	2.3	18.8	18.8	<0.1	<0.1	<0.1	<0.1	NR	NR	DRY	1.10	N
ıd We	Monitoring	WS3	15:05	1025	<0.1	<0.1	<0.1	1.9	1.9	18.7	18.7	<0.1	<0.1	<0.1	<0.1	NR	NR	1.87	1.91	N
st, Ha		WS4	15:15	1025	<0.1	<0.1	<0.1	2.6	2.6	18.1	18.1	<0.1	<0.1	<0.1	<0.1	NR	NR	DRY	2.03	N
tfield	Results																			
AL10																				
9RH																				
Figu	Job ]																			
Figure No:	No:																			
A								NI	) = Below d	etection lin	nit of instru	ment. NR =	= Not Read							
A2.12 cont'd	52406	Readings	a Taken By:		FA							Checked		DA						
ont'd	904																			

				Date of	f Visit	22/12	/2015													
AS	IA			CH <sub>4</sub> %	∕ov/v	CO <sub>2</sub>	%v/v	$O_2^{0}$	∕ov/v	H <sub>2</sub> S	ppm	СО	ppm	VOC	ppm					
SOC	N F	Backgroun	d Readings:	<0	.1	<	).1	2	1.1	<	0.1	<	).1	<	).1					
TIA	ARA	Ducingi our	u iteuuings.		Weat	her Conditi	ons		Windy											
ASSOCIATES	MEK				Ground Cor	ditions (dry	/wet etc.)		Wet											
					Atmosph	eric Pressu	re (mb)		1007											
0 10 1	Gas a	Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕o v/v	H <sub>2</sub> S	ppm	CO	ppm	voo	C ppm	Water Level	Depth of Well	Water Sample Y
	and (		()	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
	Groundwater	BH1	13:15	1007	<0.1	<0.1	<0.1	1.1	1.1	21.0	21.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	4.62	5.72	Y
	Wate	BH2	13:25	1007	<0.1	<0.1	<0.1	1.0	1.0	20.8	20.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	8.88	9.75	Y
		WS1	13:35	1007	<0.1	<0.1	<0.1	2.0	2.0	19.1	19.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	DRY	1.10	N
	Monitoring	WS3	13:45	1006	<0.1	<0.1	<0.1	1.9	1.9	19.1	19.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.98	1.92	N
		WS4	13:55	1006	<0.1	<0.1	<0.1	2.1	2.1	18.8	18.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	DRY	2.03	N
	Results																			
	Jobl																			
	No:																			
								NI	) = Below d	etection lin	nit of instru	ment. NR =	= Not Read.							
Î	52406	Readings	Taken By:		FA							Checked	By:	DA						

		Date of	f Visit	04/01	/2016													
		CH <sub>4</sub> %	∕ov/v	CO <sub>2</sub>	% v/v	O <sub>2</sub>	∕ov/v	H <sub>2</sub> S	ppm	CO	ppm	VOC	ppm					
Backgroun	d Readings:	<0	.1	<	).1	2	1.2	<	0.1	<	0.1	<	).1					
Dackgroun	u Keaungs.		Weat	her Conditi	ons		Overcast	į										
			Ground Cor	nditions (dr	/wet etc.)		Wet											
			Atmosph	eric Pressu	re (mb)		977											
Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕0 V/V	H <sub>2</sub> S	ppm	CO	ppm	VOC	C ppm	Water Level	Depth of Well	Water Sample Y
	()	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
BH1	12:30	977	<0.1	<0.1	<0.1	4.1	4.1	16.9	16.9	<0.1	<0.1	<0.1	<0.1	0.1	0.1	4.77	5.73	N
BH2	12:40	977	<0.1	<0.1	<0.1	5.3	5.3	14.7	14.7	<0.1	<0.1	<0.1	<0.1	0.2	0.2	8.87	9.75	N
WS1	12:50	977	<0.1	<0.1	<0.1	3.9	3.9	15.9	15.9	<0.1	<0.1	<0.1	<0.1	0.3	0.3	DRY	1.06	N
WS3	13:00	977	<0.1	<0.1	<0.1	5.1	5.1	10.9	10.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.10	1.90	N
WS4	13:10	977	<0.1	<0.1	<0.1	3.9	3.9	13.7	13.7	<0.1	<0.1	<0.1	<0.1	0.2	0.2	1.34	2.00	N
						NI	) = Below d	etection lin	nit of instru	ment. NR =	= Not Read.							
Readings	Taken By:		МС	Ĵ						Checked	l By:	VT						

Geo	•																			
technic	D			Date of	f Visit	13/01	/2016													
al & Env	IAI			CH <sub>4</sub> %	∕ov/v	CO <sub>2</sub>	%v/v	029	%v/v	H <sub>2</sub> S	ррт	СО	ррт	VOC	C ppm					
ronmer	IAN FARMER ASSOCIATES	Backgroun	d Readings:	0.	1	<	0.1	2	1.4	<	0.1	<	).1	<	0.1					
ital Spe	ARM		0			her Conditi			Clear											
cialists	ES				Ground Cor				Damp											
			1		Atmosph	eric Pressu	re (mb)		1011									1	1	
Rama	Gas a	Hole No:	Time (hh:mm)	Atmos. Pressure	Gas Flow Rate	CH4	% v/v	CO <sub>2</sub>	% v/v	O <sub>2</sub> %	∕o v/v	H <sub>2</sub> S	ppm	CO	ppm	VOC	C ppm	Water Level	Depth of Well	Water Sample Y
da Ho	and C		()	(mb)	(l/hr)	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	mBGL	mBGL	/ N
Ramada Hotel, St Albans Road West, Hatfield AL10 9RH	Groundwater	BH1	13:00	1011	<0.1	0.1	0.1	1.0	1.0	19.5	19.5	<0.1	<0.1	<0.1	<0.1	0.1	0.1	4.50	5.75	N
Albai	dwate	BH2	12:50	1010	<0.1	0.1	0.1	0.2	0.2	21.0	21.0	<0.1	<0.1	<0.1	<0.1	0.1	0.1	8.84	9.75	N
ıs Roa	r Monitoring	WS1	12:44	1010	<0.1	0.1	0.1	1.8	1.8	17.2	17.2	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.72	1.07	N
d We	nitor	WS3		1		1	1			1	Not mor	nitored	1	1	1	1	1	1	1	
est, Ha		WS4	12:55	1010	<0.1	0.1	0.1	3.9	3.9	13.9	13.9	<0.1	<0.1	<0.1	<0.1	0.1	0.1	1.23	2.03	N
tfield	Results																			
AL10																				
9RH																				
Figur	Job N																			
Figure No:	No:																			
Α								NI	D = Below d	etection lin	nit of instru	ment. NR =	= Not Read.							
A2.12 cont'd	52406	Readings	s Taken By:		MO	3						Checked	l By:	VT						
)nt'd	90																			