

**New Settlement Area, Heyford Park,
Oxfordshire**

**Dorchester Phase 5C -
Post Remediation Vapour Risk Assessment**

For: Dorchester Heyford Park Group Ltd

March 2020

R1742d-R01-v1 Final

DOCUMENT CONTROL SHEET

Report Title: New Settlement Area, Heyford Park, Oxfordshire
Dorchester Phase 5C - Post Remediation Vapour Risk
Assessment

Client: Dorchester Heyford Park Group Ltd

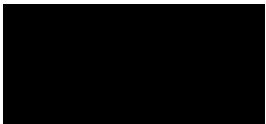
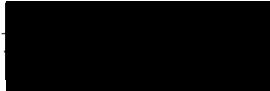
Report Reference Number: R1742d-R01

Issue Final

Version: Version 1

Report Date: 17th March 2020

Signed for Smith Grant LLP

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Document Revision Record:

Version	Report Status	Date	Details of Revision
v1	Final	17.03.20	Final; issue to client

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NEW SETTLEMENT AREA, HEYFORD PARK, OXFORDSHIRE

DORCHESTER PHASE 5C - POST REMEDIATION VAPOUR RISK ASSESSMENT

For: Dorchester Heyford Park Group Ltd

March 2020

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1. Introduction

- 1.1 Remediation earthworks to prepare the Dorchester Phase 5 area of the Heyford Park development off Camp Road, Upper Heyford, for a residential land use have been undertaken by Urban Regen Ltd. (URL) on behalf of Dorchester Homes (DH). Smith Grant LLP (SGP) were appointed to validate the remedial works carried out on the site.
- 1.2 The Remediation Strategy (R1742-R01) for the site (under the planning boundary for the New Settlement Area) was prepared and submitted to Cherwell District Council (CDC) and was approved on 01.10.14.
- 1.3 The Strategy identified that the main contamination sources requiring remediation within the New Settlement Area were underground storage tanks which were used to store fuels associated with a former fuel filling station and several boiler houses. No other locations or sources of contamination had been identified through the previous assessments.
- 1.4 Preparatory earthworks have been completed within the Dorchester Phase 5 area and have been reported in several phases due to the size of the site; these are as follows:
 - R1742b-R10-v2 (February 2016)
 - R1742b-L03 (December 2017)
 - R1742b-L06 (May 2018)
- 1.5 During construction works in the north of Dorchester Phase 5 (herein referred to as Phase 5C), an area of previously uncharacterised contamination was identified consisting of bitumen and diesel impacted soils beneath a cover of replaced weathered bedrock. Following identification of the contamination, the Local Authority was notified by letter (R1742-190618) and remediation of the contaminated area was carried out by URL under the approved Strategy. These works were carried out over 3 phases and Remediation Works Verification Reports were prepared (refs. R1742b-R16-v2 and R1742-R18-v1) and submitted to Cherwell District Council & South Northamptonshire Council (CDC/SNC) for comment on 08.08.18 and 08.01.20, respectively.
- 1.6 The Remediation Works Verification Reports confirmed that all feasible extents of contamination had been removed but that residual contamination may remain within either impacted bedrock (the Strategy does not require the remediation of bedrock) or within potentially impacted soils beneath retained roads to the north (Camp Road) and south of the excavation area.
- 1.7 SGP recommended (R1742-R18-v1) that either further risk assessment should be undertaken using vapour monitoring wells or that a precautionary approach through the installation of a ventilated void and installation of gas membranes specific for hydrocarbon resistance should be installed within Plots 869-891. The proposed development layout for Phase 5C is attached to this report (Drawing ref. 0521-PH5C-102).

- 1.8 Dorchester Homes' preferred option was to undertake vapour monitoring and assessment to establish where the installation of VOC protection measures is necessary. SGP produced and submitted a propose scope of works for the VOC assessment (ref. R1742d-L20200108) to CDC/SNC on 09.01.20, a formal response approving the methodology was received on 10.01.20.
- 1.9 This report details the findings of the above assessment, provides a further quantitative risk assessment on the results and makes recommendations on further monitoring / precautionary mitigation measures as necessary.

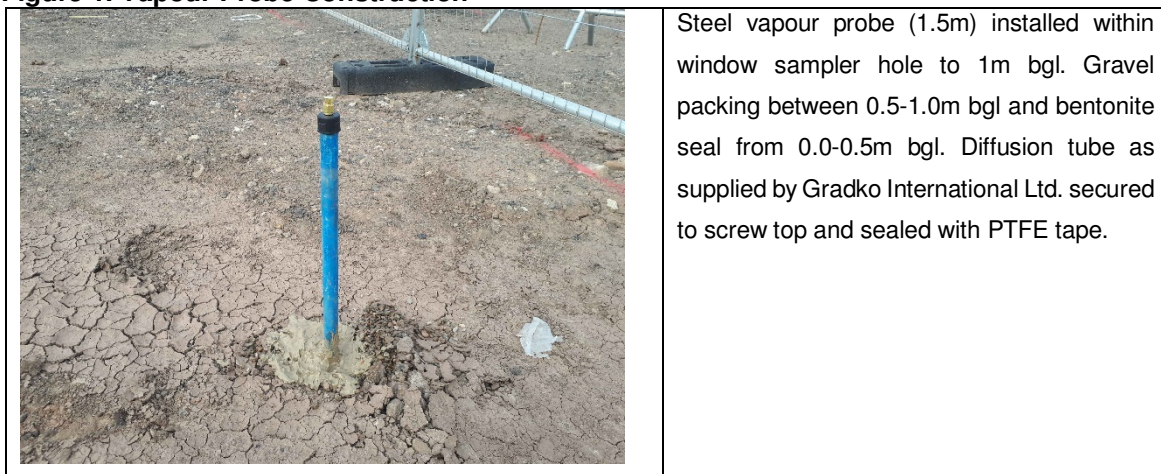
2. Methodology

2.1 Monitoring Locations and Installations

2.1.1 Installations for the monitoring of VOCs were constructed on 22.01.20 in accordance with British Standard BS8576:2013¹ (Section 10.2.3) and were located on an approximate 50m spacing in the footprints of the proposed buildings as indicated on Drawing D01. This involved the drilling of 8 boreholes extending to 1m below ground level and placement of 1.5m steel monitoring probes with holes drilled in the bottom 0.5m to provide a response zone into the window sampler boreholes. Approximately 0.5m of the probe was left above ground level allow their identification and minimise potential disturbance or destruction. The lower 0.5m was surrounded by permeable fill (10mm single-sized stone gravel) and an annulus of hydrated bentonite pellets was compacted at the surface to provide a sufficient seal.

2.1.2 Following installation of the probes, passive diffusion tubes (provided by Gradko International Ltd.) with appropriate adsorption media for volatile aliphatic and aromatic hydrocarbons (<C16 and BTEX) were secured to the probe caps and sealed with PTFE tape. The diffusion tubes were then left in-situ for a period specified by the laboratory (3 weeks) to allow sufficient adsorption of determinants and achieve a suitable limit of detection (LOD) for comparison with assessment criteria.

Figure 1. Vapour Probe Construction



2.1.3 A travel blank (to check for cross-contamination which remained sealed) and an external tube to provide background concentrations located in the northeast corner of the site were also used during the monitoring period.

2.1.4 Diffusion tubes were left in-situ for a period of 3 weeks before collection on 13.02.20, tubes were then couriered to Gradko International Ltd. analysis (lab ref. O01578R).

¹ BS 8576:2016 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)

2.2 Derivation of Inhalation Assessment Criteria

2.2.1 To determine whether concentrations of the contaminants of concern were present at a level which may pose a risk to human health, derivation of assessment criteria was carried out.

2.2.2 The methodology for deriving assessment screening criteria for health impacts from VOCs at the receptor is set out in Appendix 9 of the VOC handbook². Tolerable Daily Soil Intake values or Index Doses (for non-carcinogens and carcinogens respectively) are multiplied by the body weight (13.3 kg) and divided by the inhalation rate (8.8 m³/day) of a child receptor as defined in the most recent published UK guidance (DEFRA C4SL). Most of the substances under consideration have toxicological inhalation data published in the “LQM/CIEH S4ULs for Human Health Risk Assessment” (S4UL) - *Copyright Land Quality Management Limited reproduced with Permission* or CL:AIRE “Soil Generic Assessment Criteria for Human Health Risk Assessment”.

2.2.3 TDI’s and / or ID’s used in the determination of inhalation assessment criteria and are summarised in the table below:

Table 1. Derived Inhalation Assessment Criteria

Contaminant	Index Dose/Tolerable Daily Intake (µg/kg.bw.day ⁻¹)	Assessment Criteria (µg.m ³)
Benzene	1.4 (S4UL)	2.12
Toluene	1400 (S4UL)	2,115.91
Ethylbenzene	74.3 (S4UL)	112.29
m/p-xylene	60 (S4UL)	90.68
o-xylene	60 (S4UL)	90.68
Aliphatic Hydrocarbons (C6-C8)	5000 (S4UL)	7,556.82
Aliphatic Hydrocarbons (C8-C10)	290 (S4UL)	438.3
Aliphatic Hydrocarbons (C10-C12)	290 (S4UL)	438.3
Aliphatic Hydrocarbons (C12-C16)	290 (S4UL)	438.3
Aromatic Hydrocarbons (C5-C7)	1400 (S4UL)	2,115.91
Aromatic Hydrocarbons (C7-C8)	1400 (S4UL)	2,115.91
Aromatic Hydrocarbons (C8-C10)	60 (S4UL)	90.68
Aromatic Hydrocarbons (C10-C12)	60 (S4UL)	90.68
Aromatic Hydrocarbons (C12-C16)	60 (S4UL)	90.68

2.2.4 The assessment criteria are inherently conservative, as they assume long-term, constant exposure of residents over 24 hr periods, 365 days a year and a continuous source which does not diminish over time. However, for the most vulnerable receptors, infants and small children, significant amounts of time spent within dwellings may be anticipated.

² CIRIA C682: The VOCs Handbook: Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination 2009

3. Vapour Risk Assessment

3.1. Comparison of soil-vapour concentrations determined through diffusion tube monitoring are compared to the derived inhalation assessment criteria in the table below with laboratory results provided in Appendix A.

Table 2. Derivation of Assessment Criteria and Comparison to Soil-Vapour Concentrations

Contaminant	Assessment Criteria ($\mu\text{g}/\text{m}^3$)	Soil-Vapour Range of concentrations ($\mu\text{g}/\text{m}^3$)	Exceedances
Benzene	2.12	0.7-4.6	V1, V7
Toluene	2,115.91	0.7-5.9	None
Ethylbenzene	112.29	<0.5-0.8	None
m/p-xylene	90.68	<0.5-1.8	None
o-xylene	90.68	<0.5-0.7	None
Aliphatic Hydrocarbons (EC6-8)	7,556.82	<1.6-145	None
Aliphatic Hydrocarbons (EC8-10)	438.3	Not detected – 7,513	V1, V2, V3
Aliphatic Hydrocarbons (EC10-12)	438.3	Not detected – 1,195	V1
Aliphatic Hydrocarbons (EC12-16)	438.3	Not detected – 3.9	None
Aromatic Hydrocarbons (EC5-7)	2,115.91	0.7-4.6	None
Aromatic Hydrocarbons (EC7-8)	2,115.91	0.7-5.9	None
Aromatic Hydrocarbons (EC8-10)	90.68	Not detected – 1.6	None
Aromatic Hydrocarbons (EC10-12)	90.68	Not detected – 5.5	None
Aromatic Hydrocarbons (EC12-16)	90.68	Not detected	None

3.2. Exceedances of the derived assessment criteria for the aliphatic hydrocarbon range EC8-EC10 were reported within vapour probes 'V1' ($7513 \mu\text{g}/\text{m}^3$), 'V2' ($665 \mu\text{g}/\text{m}^3$) and 'V3' ($453 \mu\text{g}/\text{m}^3$), as well as the aliphatic hydrocarbon range EC10-E12 within probe 'V1' at $1,195 \mu\text{g}/\text{m}^3$. Exceedances for benzene were also reported within vapour probes 'V1' and 'V7' at $4.3 \mu\text{g}/\text{m}^3$ and $4.6 \mu\text{g}/\text{m}^3$, respectively.

3.3. Concentrations of TEX, Aliphatic EC6-8/EC12-16 and Aromatic EC5-12 hydrocarbon compounds were also reported above detection limits, but not at concentrations exceeding the assessment criteria.

3.4. Whilst exceedances within the soil-vapour phase have been reported for benzene and the aliphatic hydrocarbon ranges EC8-EC10 and EC10-E12, this does not necessarily represent concentrations within future dwellings and so further assessment is required to determine the likelihood whether indoor air concentrations would exceed the assessment criteria.

3.5. Quantitative Vapour Risk Assessment

The CLEA model predicts indoor vapour concentrations based on the Johnson and Ettinger (1991) equations utilising predicted soil-gas concentrations as derived through CLEA. Site specific soil-gas concentrations as determined through monitoring (as described above), and the maximum recorded concentrations for benzene and the aliphatic hydrocarbon ranges EC8-EC10 and EC10-E12 have been input into the CLEA v1.071 model to derive site-specific indoor vapour concentrations for comparison to health-critical indoor air targets.

- 3.6. To produce an assessment of predicted indoor vapour concentrations, site-specific criteria have been adopted where possible supplemented by literature-based or default values. A summary of the CLEA parameters of contaminant, building, soil and receptor are provided below whilst values and their justification / source are referenced in Appendix B.

Contaminant

- 3.7. Physio-chemical and toxicological values for benzene and the aliphatic hydrocarbon ranges EC8-EC10 and EC10-E12 were adopted from the LQM/CIEH Suitable For Use Levels for Human Health Risk Assessment³.
- 3.8. Default CLEA values as reported within CLEA SR3⁴ and used within the production of S4ULs were adopted as sub-surface soil to indoor air correction factors as contaminant specific values are not available.

Building

- 3.9. A number of building parameters including air exchange rates, pressure difference, floor crack area, dust loading factor and soil gas ingress rate were used based on the CLEA SR3 default building parameters for residential properties. In the absence of default parameters for apartments and where site-specific data is not available, the worst-case values for the differing types of residential properties have been utilised where applicable to allow for a conservative assessment (i.e. floor crack area – bungalow).
- 3.10. To allow a conservative yet representative assessment, the size of the smallest apartment (as detailed in plans provided by DL) has been utilised. This corresponds to Plot 875 which has a footprint of approximately 57m² and a living space height of 2.4m. The minimum specified thickness of C30 concrete topping overlying the block and beam foundation construction (75mm) has also been utilised for the 'foundation thickness' value.

Soil

- 3.11. The Phase 5C Remediation Works Verification Reports describe that the soils replaced following excavation and removal of grossly contaminated soils comprised a small volume of weathered

³ Nathaniel, C.P., McCaffrey, C., Gillet, A.G., Ogden, R.C. and Nathaniel, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Copyright LQM/CIEH – All rights reserved

⁴ Environment Agency. 2009. Updated Technical Background to the CLEA Model. Science Report: SC050021/SR3

limestone bedrock fill and more substantial quantities of clay. To allow for a highly conservative assessment, the worst-case granular constituent (sand) soil has been adopted as the dominant soil type.

- 3.12. Soil Organic Matter (SOM) and pH values of 1.5% and 8.6 respectively have been generated through averaging of soil data from formation sampling across the wider Phase 5 area.

Receptor

- 3.13. A future site resident has been identified as the critical receptor with the model utilising the CLEA default values as reported within the SR3 document for a female aged between 0 and 6 years.

3.14. CLEA Predicted Indoor Air Concentrations

The CLEA model was run utilising the updated published values and site-specific criteria for all of the contaminants which exceeded the derived inhalation criteria with an inhalation exposure pathway only. The output values are summarised in the table below with CLEA output worksheets provided in Appendix C and are compared to derived inhalation assessment criteria as reproduced in Table 3.

Table 3 Comparison of assessment criteria and CLEA predicted indoor air concentrations

Compound	CLEA predicted indoor air concentration (µg.m ³)	Assessment Criteria (µg.m ³)	Exceedances
Benzene	0.000432	2.12	None
Aliphatic Hydrocarbons (EC8-10)	0.731	438.3	None
Aliphatic Hydrocarbons (EC10-12)	0.116	438.3	None

- 3.15. The predicted indoor air concentrations of benzene (0.000432 µg.m³), aliphatic hydrocarbons EC8-10 (0.731 µg.m³) and EC10-12 (0.116 µg.m³) are all substantially below the derived inhalation assessment criteria of 2.12 µg.m³, 438.3 µg.m³ and 438.3 µg.m³, respectively. This assessment is considered to be highly conservative based on the assumptions made, including duration of indoor occupation, sand as being the predominant soil type and the smallest dwelling type. It is also recognised that the model does not take into account the dilution and dispersion that takes place within the sub-floor void which is to be constructed under current foundation designs.

4. Conclusions and Recommendations

- 4.1. Previous investigation and validation data from soils analysis had indicated that volatile hydrocarbons were the main contaminants of concern in the remediated hotspot area. In-situ vapour monitoring was completed on an approximate 50m spacing with vapour probes located in the footprints of proposed buildings to intercept the potential pathway of any residual contaminants migrating from the remediated hotspot into future dwellings. Concentrations of BTEX and volatile hydrocarbons (<C16) within the soil-gas phase were compared to derived inhalation criteria with concentrations of benzene and aliphatic hydrocarbon ranges EC8-10 and EC10-12 exceeding the criteria within a total of four locations ('V1', 'V2', 'V3' and 'V7').
- 4.2. To assess the significance of the exceedances within the soil-vapour phase further, the CLEA model was used to predict indoor air concentrations. The model used authoritative physio-chemical and toxicological data for the determinants and provided a conservative assessment based on duration of occupation, soil type and building type. Site specific parameters for the building type were used to provide a representative assessment of the dwelling with the smallest living space taken from plans provided by Dorchester Living: Plot 875 (apartment).
- 4.3. Predicted indoor air concentrations were significantly below the derived inhalation assessment criteria and it is further acknowledged that the model does not take into account the protection provided by a sub-floor void where further dilution and dispersion of vapour is likely to occur. It is also acknowledged that further contamination source removal is scheduled to take place to the direct north of the hotspot remediation area which could further reduce any residual concentrations along the northern boundary.
- 4.4. The soil-vapour monitoring programme and subsequent assessment demonstrates that predicted indoor air concentrations of hydrocarbons in proposed future dwellings emanating from the remediated hotspot are substantially below derived inhalation criteria. It is also recognised that this is a highly conservative assessment. It is considered that further monitoring or assessment is not required and that there is no requirement for the installation of VOC resistant gas protection measures within plots in Phase 5C of the development.
- 4.5. It is recommended that all plots within the Phase 5C are constructed with a sub-floor void to allow sufficient dilution and dispersion of any residual vapours.

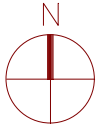
General

- 4.6. This report has been prepared by SGP for the sole and exclusive use of Dorchester Heyford Park Group Ltd. Reasonable skill, care and diligence has been exercised within the budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the

whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.

- 4.7. Any comments made on soil-air vapour conditions are based on observations or tests made at the time that the work was carried out. It should be noted that concentrations of substances may vary according to seasonal or weather-related effects, sometimes in an unpredictable fashion.
- 4.8. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

DRAWING



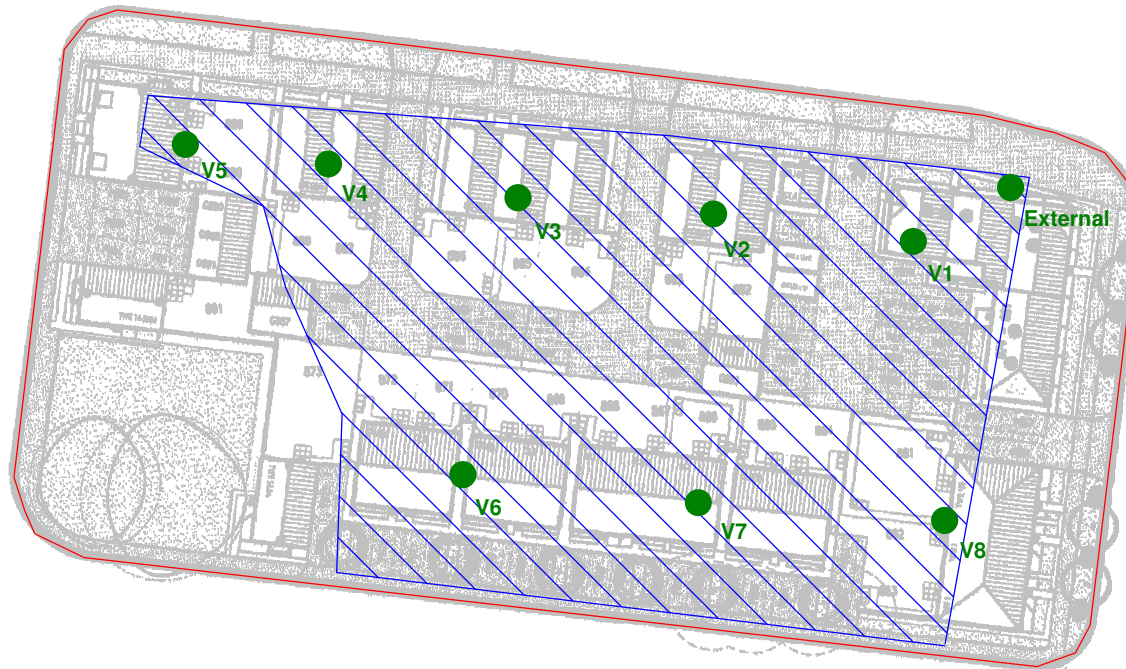
Site Boundary



Hotspot Excavation Extents



Diffusion Tube Locations



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Project: Heyford Park, Dorchester Phase 5C	
Drawing: Diffusion Tube Locations	
Drawn: SM	Checked: DW
Date: 12.02.20	Scale: 1:750 @ A4
Job No: R1742d	Dwg No: R1742d-R01-D01

PHASE 5C, HEYFORD PARK, UPPER HEYFORD, BICESTER

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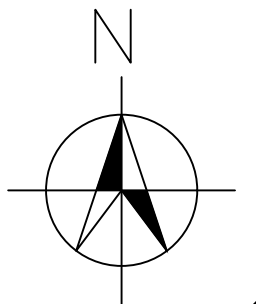
LEGEND

SITE BOUNDARIES			
	APPLICATION BOUNDARY		
EXISTING VEGETATION			
	EXISTING TREE TO BE RETAINED		EXISTING RPA
	EXISTING VEGETATION TO BE REMOVED		
EXTERNAL BOUNDARY TREATMENTS			
	1800mm HIGH SCREEN WALL (REFER TO MATERIALS LAYOUT 0521-PHS-SD-SR-108 FOR MATERIALS)		1800mm HIGH CLOSE BOARD TIMBER FENCE
	1800mm HIGH PLOT DIVISION PANEL FENCE		1800mm HIGH TIMBER MATCHBOARD ACCESS GATE
NUMBERING			
12	PLOT NUMBERS	G12	GARAGE NUMBERS
V	VISITOR PARKING	(h)	PLOT HANDING
P12	PARKING NUMBERS	BM	BIN MUSTER AREA
SSP	SUBSTATION PARKING		
MISCELLANEOUS			
	CHIMNEY		PERSONNEL ACCESS
	AFFORDABLE HOUSING - RENTED		GARAGE ACCESS
	BIN HARDSTANDING WITH 1.5m TURNING CIRCLE		EXISTING BUILDING
	LOCATION OF WHEELCHAIR UNIT'S PARKING SPACE		WHEELCHAIR UNIT
	ROTARY DRYER		COMPOST BIN
	BIN HARDSTANDING		WATER BUTT
GROUND SURFACING			
	MARSHALLS KEYBLOK BLOCK PAVING COLOUR: BRINDLE		RAMP / RUMBLE STRIP TO ENGINEERS DESIGN
	MARSHALLS PIORA CONCRETE BLOCK PERMEABLE PAVING COLOUR: BRINDLE		PAVING SLABS
	TARMAC		450mm x 450mm MARSHALLS SAXON BUFF PATIO SLABS
LANDSCAPING			
	PROPOSED NEW TREE (REFER TO SEPARATE LANDSCAPING DRAWINGS FOR EXACT DETAILS)		PROPOSED HEDGEROW (REFER TO SEPARATE LANDSCAPING DRAWINGS FOR EXACT DETAILS)
	PROPOSED GRASS PLANTING (REFER TO SEPARATE LANDSCAPING DRAWINGS FOR EXACT DETAILS)		PROPOSED PLANTING BEDS (REFER TO SEPARATE LANDSCAPING DRAWINGS FOR EXACT DETAILS)

ACCOMMODATION SCHEDULE

OPEN MARKET					
Name	Stories	Bedrooms	Gross sqft	No. Of Units	
DL2	2 Storey	3 Bed house	888ft ²	3	
DL6	2 Storey	3 Bed house	858ft ²	6	
Type 1	2 Storey	3 Bed house	1023ft ²	3	
TYPE 1A-SA (side access)	2 Storey	3 Bed house	1038ft ²	2	
SP7C	2.5 Storey	4 Bed house	1400ft ²	1	
SP7B	2.5 Storey	4 Bed house	1400ft ²	1	
SP2-V3	3 Storey	4 Bed house	1523ft ²	7	
TOTAL				23	
AFFORDABLE HOUSING UNITS - RENTED					
Name	Stories	Bedrooms	sqft		
SPF9 1BF3	3 Storey	1 Bed flat	490ft ²	1	
SPF9 1BF2	3 Storey	1 Bed flat	506ft ²	2	
SPF9 1BF1	3 Storey	1 Bed flat	597ft ²	1	
SPF9 2BM2	3 Storey	2 Bed maisonette	813ft ²	1	
SPF9 2BM (DIS)	3 Storey	2 Bed maisonette	829ft ²	1	
SPF9 2BF1	3 Storey	2 Bed flat	829ft ²	1	
SPF9 2BM3	3 Storey	2 Bed maisonette	831ft ²	1	
TOTAL				8	
TOTAL AFFORDABLE UNITS				8	
GRAND TOTAL				31	

- REVISIONS:
- A. 2019-06-27. Plot 26 adjusted to ensure AD.M4(3) compliancy. DJE
 - B. 2019-10-03. Red line, plot numbers and schedule updated. MED



PLANNING LAYOUT

SCALE: 1:500 @ A3
 DATE: DECEMBER 2018
 DRAWN: DGK
 DRAWING TITLE: PLANNING LAYOUT
 DRAWING NO: 0521-PH5C-102

THE OLD BREWERY, LODWAY, PILL, BRISTOL BS20 0DH
 t:01275 813380 f:01275 813381 e:admin@focusdp.com



APPENDIX A

Analytical Results

LABORATORY ANALYSIS REPORT

Report Number 001578R
Customer Smith Grant LLP
Station House
Station Road
Ruabon, Wrexham
LL14 6DL
Booking In Reference S0256
Despatch Note Number 76384
Date Samples Received 17/02/2020
Diffusion Tube Type Tenax
Job Reference R1742d

Quantitative Analysis of BTEX

Identification and estimation of ng on tube in accordance with ISO16000-6

Tube Number 004561
Gradko Lab Reference 0800212
Exposure Time (mins)* 31539
Sample ID V1

BTEX	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	30.7	1.4	4.3
Toluene	52.2	1.6	5.9
Ethylbenzene	6.8	0.1	0.6
m/p-Xylene	17.3	0.4	1.6
o-Xylene	7.8	0.2	0.7

EC6-EC8 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Octane	94	693	11.0	50.1
Cyclohexane, 1,3-dimethyl-, cis-	91	374	5.9	26.6
Cyclohexane, 1,4-dimethyl-, trans-	94	321	5.1	22.8
Cyclohexane, 1,3-dimethyl-, trans-	94	121	1.9	8.6
Heptane, 3-methyl-	95	119	1.9	8.6
Cyclohexane, methyl-	94	102	1.6	6.3
Cyclopentane, 1-ethyl-3-methyl-, trans-	94	93	1.5	6.6
Cyclopentane, 1-ethyl-2-methyl-, cis-	93	46	0.7	3.3
Heptane	91	37	0.6	2.3
Cyclopentane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.alpha.)-	95	23	0.4	1.7
Hexane	87	19	0.3	1.0
Cyclopentane, 1,2,3-trimethyl-, (1.alpha.,2.alpha.,3.beta.)-	94	15	0.2	1.1
Cyclopentane, ethyl-	95	14	0.2	0.8
Hexane, 3-methyl-	90	13	0.2	0.8
Cyclopentane, 1,2-dimethyl-, trans-	91	12	0.2	0.7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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L. Gates, Laboratory Manager

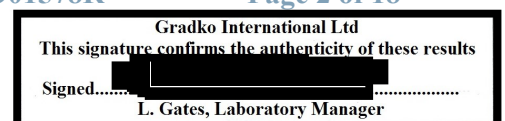
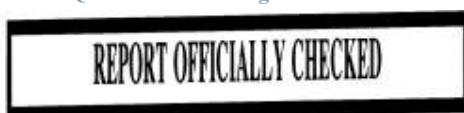
LABORATORY ANALYSIS REPORT

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Cyclopentane, methyl-	94	11	0.2	0.6
Hexane, 2,4-dimethyl-	94	10	0.2	0.7
<i>Cyclopentane, 1,3-dimethyl-, trans-</i>	76	10	0.2	0.6
Hexane, 2,5-dimethyl-	95	8	0.1	0.6
Cyclopentane, 1,3-dimethyl-, cis-	90	6	0.1	0.4
<i>Pentane, 2,3-dimethyl-</i>	59	<5	<0.1	<0.3
Total**		2053	32.6	145

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>8-EC10 Aliphatic Hydrocarbons**				
Decane	95	12884	204	1160
Nonane	95	8765	139	711
Nonane, 4-methyl-	94	8606	136	775
Nonane, 2-methyl-	87	7446	118	671
<i>Cyclohexane, butyl-</i>	62	6811	108	605
Cyclohexane, 1,2,4-trimethyl- (sum of isomers)		6676	106	533
Nonane, 3-methyl-	91	5902	94	531
cis-1-Ethyl-3-methyl-cyclohexane	91	5507	87	440
Cyclohexane, 1-ethyl-2-methyl-	91	4897	78	391
Octane, 2-methyl-	91	3844	61	312
Cyclohexane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.beta.)-	91	3226	51	258
Octane, 3-methyl-	91	3179	50	258
Cyclohexane, 1-ethyl-4-methyl-, trans-	91	3038	48	243
Heptane, 2,4,6-trimethyl-	94	1999	32	180
Cyclohexane, 1-ethyl-4-methyl-, cis-	93	1841	29	147
Cyclohexane, 1,3,5-trimethyl-	95	1812	29	145
Cyclohexane, ethyl-	94	1071	17	76
Heptane, 2,6-dimethyl-	91	414	6.6	34
Cyclohexane, 1,1,3-trimethyl-	92	285	4.5	23
<i>Heptane, 2,4-dimethyl-</i>	83	149	2.4	12
<i>Hexane, 3-ethyl-2-methyl-</i>	83	69	1.1	5.6
<i>Heptane, 2,2-dimethyl-</i>	38	31	0.5	2.5
Total**		88453	1402	7513

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>10-EC12 Aliphatic Hydrocarbons**				
Undecane	95	4326	69	428
Decane, 4-methyl-	93	3535	56	350
Decane, 2-methyl-	95	3030	48	300
Cyclohexane, pentyl-	87	1203	19	118
Total**		12094	192	1195

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LABORATORY ANALYSIS REPORT

EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library			
Tridecane	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
	95	33	0.5	3.9

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

EC>8-EC10 Aromatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	
		<5	<0.1	

EC>10-EC12 Aromatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	
		<5	<0.1	

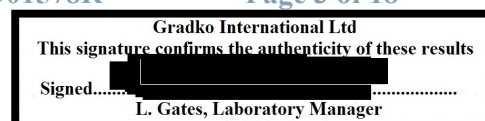
EC>12-EC16 Aromatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	
		<5	<0.1	

Tube Number 004467
Gradko Lab Reference 0800213
Exposure Time (mins)* 31539
Sample ID V2

BTEX		ng on tube	ppb in air*	µgm⁻³*
Benzene		12.3	0.6	1.7
Toluene		12.6	0.4	1.4
Ethylbenzene		2.6	0.1	0.2
m/p-Xylene		6.4	0.1	0.6
o-Xylene		<5	<0.1	<0.5

EC6-EC8 Aliphatic Hydrocarbons**	NIST Library			
Cyclohexane, 1,3-dimethyl- (sum of isomers)	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Cyclohexane, 1-ethyl-4-methyl-, trans-	91	275	4.4	20
<i>Cyclohexane</i>	60	153	2.4	12
Cyclohexane, methyl-	60	39	0.6	2.1
Hexane	94	28	0.4	1.7
Heptane	86	16	0.3	0.9
Cyclopentane, methyl-	91	15	0.2	0.9
	94	10	0.2	0.5

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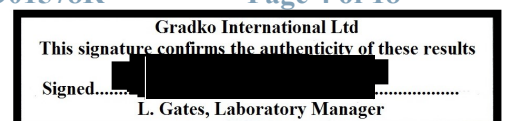
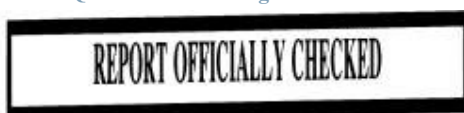
LABORATORY ANALYSIS REPORT

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
<i>Cyclopentane, 1-ethyl-2-methyl-, cis-</i>	50	9	0.1	0.7
<i>Cyclohexane, 1,4-dimethyl-, cis-</i>	91	8	0.1	0.6
<i>Hexane, 3-methyl-</i>	58	8	0.1	0.5
<i>Heptane, 3-methyl-</i>	83	<5	<0.1	<0.4
Total**		566	9.0	40

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>8-EC10 Aliphatic Hydrocarbons**				
Decane	95	2247	36	202
Nonane, 2-methyl-	87	978	16	88
Nonane	95	830	13	67
Nonane, 3-methyl-	94	629	10	57
Nonane, 4-methyl-	91	563	8.9	51
<i>Cyclohexane, propyl-</i>	68	468	7.4	42
Octane, 2,6-dimethyl-	86	425	6.7	38
Cyclohexane, 1-ethyl-2-methyl-	91	356	5.6	28
cis-1-Ethyl-3-methyl-cyclohexane	91	295	4.7	24
Octane, 2-methyl-	87	153	2.4	12
Cyclohexane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.beta.)-	94	140	2.2	11
Octane, 3-methyl-	91	138	2.2	11
Heptane, 2,4,6-trimethyl-	94	121	1.9	11
Cyclohexane, 1-ethyl-4-methyl-, cis-	94	104	1.6	8.3
Cyclohexane, 1,3,5-trimethyl-	94	70	1.1	5.6
Cyclohexane, 1,1,3-trimethyl-	92	35	0.6	2.8
Cyclohexane, ethyl-	94	35	0.6	2.5
Cyclohexane, 1,2,4-trimethyl- (sum of isomers)		25	0.4	2.0
Heptane, 2,6-dimethyl-	91	14	0.2	1.2
Total**		7628	121	665

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>10-EC12 Aliphatic Hydrocarbons**				
Undecane	95	1276	20	126
Decane, 4-methyl-	93	633	10	63
Decane, 2-methyl-	94	598	9.5	59
<i>Cyclohexane, pentyl-</i>	83	382	6.1	37
Dodecane	78	217	3.4	23
Total**		3106	49.2	309

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LABORATORY ANALYSIS REPORT

EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*	µgm ⁻³ *
	Quality Match				
Tridecane	95		5	0.1	0.6
Hexadecane	74		<5	<0.1	<0.7
Total**			10	0.2	1.3

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

EC>8-EC10 Aromatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*
	Quality Match			
			<5	<0.1

EC>10-EC12 Aromatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*
	Quality Match			
			<5	<0.1

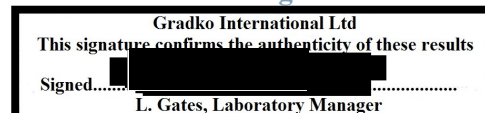
EC>12-EC16 Aromatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*
	Quality Match			
			<5	<0.1

Tube Number **004481**
 Gradko Lab Reference **08O0214**
 Exposure Time (mins)* **31538**
 Sample ID **V3**

BTEX	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	6.8	0.3	1.0
Toluene	7.0	0.2	0.8
Ethylbenzene	<5	<0.1	<0.5
m/p-Xylene	<5	<0.1	<0.5
o-Xylene	<5	<0.1	<0.5

EC6-EC8 Aliphatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*	µgm ⁻³ *
	Quality Match				
Cyclohexane, methyl-	94		11	0.2	0.7
Cyclohexane, 1,3-dimethyl-, cis-	64		<5	<0.1	<0.4
Cyclopentane, methyl-	90		<5	<0.1	<0.3
Cyclohexane, 1,4-dimethyl-, trans-	91		<5	<0.1	<0.4
Total**			<26	<0.4	<1.6

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EC>8-EC10 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Decane	95	1127	18	101
Octane, 2,6-dimethyl-	90	617	9.8	56
Cyclohexane, butyl-	64	609	9.6	54
Nonane, 2-methyl-	81	605	9.6	55
Nonane, 3-methyl-	94	399	6.3	36
Nonane	95	397	6.3	32
Nonane, 4-methyl-	91	362	5.7	33
Cyclohexane, 1-ethyl-2-methyl-	94	226	3.6	18
Cyclohexane, 1,2,4-trimethyl- (sum of isomers)		182	2.9	15
Heptane, 2,4,6-trimethyl-	94	109	1.7	9.9
Octane, 2-methyl-	90	106	1.7	8.6
Octane, 3-methyl-	91	98	1.6	8.0
Cyclohexane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.beta.)-	91	94	1.5	7.5
Cyclohexane, 1-ethyl-4-methyl-, trans-	91	87	1.4	6.9
Cyclohexane, 1-ethyl-4-methyl-, cis-	91	59	0.9	4.7
Cyclohexane, 1,3,5-trimethyl-	91	45	0.7	3.6
Cyclohexane, 1,1,3-trimethyl-	97	19	0.3	1.5
Cyclohexane, ethyl-	90	15	0.2	1.1
Heptane, 4-ethyl-	35	15	0.2	1.2
Heptane, 2,6-dimethyl-	83	12	0.2	0.9
Total**		5182	82.2	453

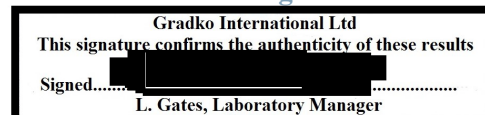
EC>10-EC12 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Undecane	95	902	14	89
Decane, 4-methyl-	87	432	6.9	43
Decane, 2-methyl-	94	386	6.1	38
Cyclohexane, pentyl-	81	327	5.2	32
Dodecane	68	293	4.6	32
Total**		2339	37.1	234

EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Tridecane	83	9	0.1	1.0

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

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LABORATORY ANALYSIS REPORT

EC>8-EC10 Aromatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*
	<5	<0.1

EC>10-EC12 Aromatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*
	<5	<0.1

EC>12-EC16 Aromatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*
	<5	<0.1

Tube Number	004470
Gradko Lab Reference	0800215
Exposure Time (mins)*	31538
Sample ID	V4

BTEX	ng on tube	ppb in air*	µgm⁻³*
Benzene	6.5	0.3	0.9
Toluene	6.0	0.2	0.7
Ethylbenzene	<5	<0.1	<0.5
m/p-Xylene	<5	<0.1	<0.5
o-Xylene	<5	<0.1	<0.5

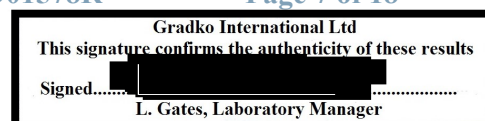
EC6-EC8 Aliphatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm⁻³*
<i>Hexane</i>	72	6	0.1
Heptane	87	<5	<0.1
Total**		11	0.2

EC>8-EC10 Aliphatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm⁻³*
Decane	95	45	0.7
Octane, 2,6-dimethyl-	93	32	0.5
Cyclohexane, 1-ethyl-2-methyl-	93	17	0.3
Nonane, 3-methyl-	91	17	0.3
Nonane, 4-methyl-	90	14	0.2
Cyclohexane, 1,2,4-trimethyl- (sum of isomers)		11	0.2
1-Ethyl-3-methylcyclohexane (c,t)	95	11	0.2
<i>Octane, 3-methyl-</i>	70	9	0.2
Cyclohexane, 1-ethyl-4-methyl-, cis-	94	6	0.1
Heptane, 2,4,6-trimethyl-	87	5	0.1
<i>Cyclohexane, 1,1,3-trimethyl-</i>	78	<5	<0.1
Cyclohexane, 1-ethyl-4-methyl-, trans-	87	<5	<0.1
Total**		177	2.8

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LABORATORY ANALYSIS REPORT

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>10-EC12 Aliphatic Hydrocarbons**				
Decane, 4-methyl-	87	20	0.3	1.9
Undecane	60	18	0.3	1.8
Dodecane	92	<5	<0.1	<0.5
Total**		42	0.7	4.2

	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>12-EC16 Aliphatic Hydrocarbons**				
Hexadecane	93	<5	<0.1	<0.7

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

	NIST Library Quality Match	Estimated ng on tube	ppb in air*
EC>8-EC10 Aromatic Hydrocarbons**		<5	<0.1

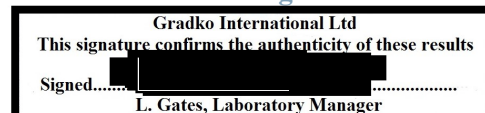
	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
EC>10-EC12 Aromatic Hydrocarbons**				
Naphthalene	43	7	0.1	0.5

	NIST Library Quality Match	Estimated ng on tube	ppb in air*
EC>12-EC16 Aromatic Hydrocarbons**		<5	<0.1

Tube Number 004506
Gradko Lab Reference 08O0216
Exposure Time (mins)* 31537
Sample ID V5

	ng on tube	ppb in air*	µgm ⁻³ *
BTEX			
Benzene	6.4	0.3	0.9
Toluene	6.2	0.2	0.7
Ethylbenzene	<5	<0.1	<0.5
m/p-Xylene	<5	<0.1	<0.5
o-Xylene	<5	<0.1	<0.5

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EC6-EC8 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Hexane	64	11	0.2	0.6
Cyclohexane, methyl-	97	7	0.1	0.5
Heptane	87	6	0.1	0.4
Cyclopentane, methyl-	81	<5	<0.1	<0.3
Cyclohexane, 1,3-dimethyl-, cis-	72	<5	<0.1	<0.4
Total**		34	0.54	2.04

EC>8-EC10 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Decane	95	82	1.3	7.4
Nonane, 2-methyl-	43	55	0.9	5.0
Nonane	94	23	0.4	1.9
Nonane, 3-methyl-	91	19	0.3	1.7
Nonane, 4-methyl-	90	17	0.3	1.5
Octane, 2,6-dimethyl-	87	16	0.3	1.4
Cyclohexane, 1-ethyl-2-methyl-	87	16	0.2	1.3
Cyclohexane, 1-ethyl-3-methyl- (c,t)	95	12	0.2	1.0
Cyclohexane, 1,1,3-trimethyl-	90	9	0.1	0.8
Cyclohexane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.beta.)-	94	9	0.1	0.8
Cyclohexane, 1-ethyl-4-methyl-, trans-	91	6	0.1	0.5
Cyclohexane, 1-ethyl-4-methyl-, cis-	81	<5	<0.1	<0.4
Total**		270	4.3	23.5

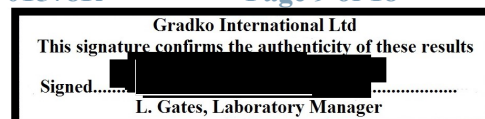
EC>10-EC12 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Undecane	91	36	0.6	3.5
Decane, 4-methyl-	90	23	0.4	2.3
Decane, 2-methyl-	91	18	0.3	1.8
Total**		77	1.2	7.6

EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library		
	Quality Match	Estimated ng on tube	ppb in air*
		<5	<0.1

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

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EC>8-EC10 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	
		<5	<0.1	
EC>10-EC12 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
<i>Naphthalene</i>	76	5	0.1	0.4
EC>12-EC16 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	
		<5	<0.1	
Tube Number	004599			
Gradko Lab Reference	08O0217			
Exposure Time (mins)*	31537			
Sample ID	V6			
BTEX		ng on tube	ppb in air*	µgm⁻³*
Benzene		5.2	0.2	0.7
Toluene		22.6	0.7	2.6
Ethylbenzene		<5	<0.1	<0.5
m/p-Xylene		<5	<0.1	<0.5
o-Xylene		<5	<0.1	<0.5
EC6-EC8 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
<i>Hexane, 2,2,5-trimethyl-</i>	59	122	1.9	9.9
Cyclopentane, methyl-	94	8	0.1	0.4
Heptane	90	6	0.1	0.4
Cyclohexane, methyl-	87	5	0.1	0.3
Total**		141	2.2	11.0
EC>8-EC10 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Decane	94	33	0.5	2.9
Octane, 2,6-dimethyl-	91	32	0.5	2.9
<i>Cyclohexane, 1-ethyl-2-methyl-</i>	76	15	0.2	1.2
Cyclohexane, 1,1,3-trimethyl-	90	14	0.2	1.1
Nonane, 3-methyl-	91	13	0.2	1.2
Nonane, 4-methyl-	94	12	0.2	1.1
Cyclohexane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.beta.)-	93	10	0.2	0.8
Cyclohexane, 1-ethyl-3-methyl- (c,t)	94	10	0.2	0.8
<i>Octane, 3-methyl-</i>	43	7	0.1	0.6
Cyclohexane, 1-ethyl-4-methyl-, trans-	87	6	0.1	0.5
<i>Heptane, 2,4,6-trimethyl-</i>	76	6	0.1	0.5
Total**		157	2.5	13.5

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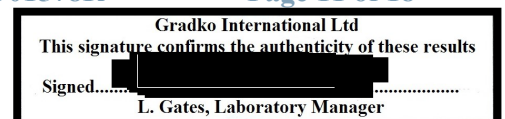
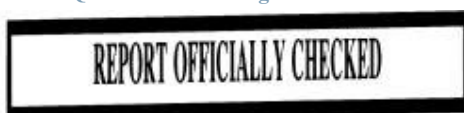
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LABORATORY ANALYSIS REPORT

<p>EC>10-EC12 Aliphatic Hydrocarbons**</p>	<p>NIST Library Quality Match</p>	<p>Estimated ng on tube</p>	<p>ppb in air*</p>	
		<5	<0.1	
<p>EC>12-EC16 Aliphatic Hydrocarbons**</p>	<p>NIST Library Quality Match</p>	<p>Estimated ng on tube</p>	<p>ppb in air*</p>	
		<5	<0.1	
<p>EC5-EC7 Aromatic Hydrocarbons**</p>				(Benzene)
<p>EC>7-EC8 Aromatic Hydrocarbons**</p>				(Toluene)
<p>EC>8-EC10 Aromatic Hydrocarbons**</p>	<p>NIST Library Quality Match</p>	<p>Estimated ng on tube</p>	<p>ppb in air*</p>	
		<5	<0.1	
<p>EC>10-EC12 Aromatic Hydrocarbons**</p>	<p>NIST Library Quality Match</p>	<p>Estimated ng on tube</p>	<p>ppb in air*</p>	
		<5	<0.1	
<p>EC>12-EC16 Aromatic Hydrocarbons**</p>	<p>NIST Library Quality Match</p>	<p>Estimated ng on tube</p>	<p>ppb in air*</p>	
		<5	<0.1	
<p>Tube Number</p>	004555			
<p>Gradko Lab Reference</p>	0800218			
<p>Exposure Time (mins)*</p>	31536			
<p>Sample ID</p>	V7			
<p>BTEX</p>		ng on tube	ppb in air*	µgm⁻³*
<p>Benzene</p>		32.8	1.5	4.6
<p>Toluene</p>		50.5	1.6	5.7
<p>Ethylbenzene</p>		8.9	0.2	0.8
<p>m/p-Xylene</p>		19.4	0.4	1.8
<p>o-Xylene</p>		7.7	0.2	0.7

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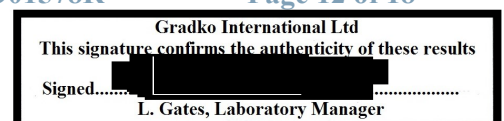
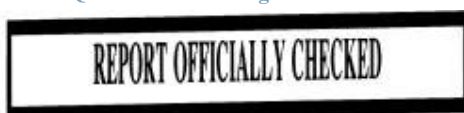


LABORATORY ANALYSIS REPORT

EC6-EC8 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Hexane	91	122	1.9	6.6
Octane	70	100	1.6	7.2
Cyclohexane	46	88	1.4	4.7
Heptane	91	76	1.2	4.8
Cyclohexane, methyl-	94	70	1.1	4.4
Hexane, 3-methyl-	91	54	0.9	3.4
Heptane, 3-methyl-	94	31	0.5	2.3
Cyclopentane, methyl-	94	25	0.4	1.3
Pentane, 2,3-dimethyl-	91	17	0.3	1.1
Cyclopentane, 1,2-dimethyl-, trans-	95	13	0.2	0.8
Cyclopentane, 1-ethyl-2-methyl-, cis-	83	11	0.2	0.8
Cyclohexane, 1,3-dimethyl-, cis-	87	9	0.1	0.6
Cyclopentane, 1,2-dimethyl-, cis-	81	7	0.1	0.4
Hexane, 2,4-dimethyl-	53	7	0.1	0.5
Cyclopentane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.alpha.)-	84	7	0.1	0.5
Cyclopentane, ethyl-	76	7	0.1	0.4
Cyclopentane, 1,2,3-trimethyl-, (1.alpha.,2.alpha.,3.beta.)-	83	6	0.1	0.4
Pentane, 2,4-dimethyl-	81	5	0.1	0.3
Cyclohexane, 1,3-dimethyl-, trans-	90	<5	<0.1	<0.4
Total**		660	10.5	41.0

EC>8-EC10 Aliphatic Hydrocarbons**	NIST Library			
	Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Decane	93	62	1.0	5.6
Nonane	93	50	0.8	4.1
Octane, 2,6-dimethyl-	92	12	0.2	1.0
Nonane, 3-methyl-	91	11	0.2	1.0
Nonane, 4-methyl-	81	10	0.2	0.9
Heptane, 2,6-dimethyl-	78	9	0.1	0.8
Cyclohexane, 1-ethyl-3-methyl- (c,t)	87	9	0.1	0.7
Cyclohexane, 1-ethyl-2-methyl-	81	9	0.1	0.7
Cyclohexane, 1,1,3-trimethyl-	91	9	0.1	0.7
Cyclohexane, ethyl-	94	8	0.1	0.6
Cyclohexane, 1-ethyl-4-methyl-, cis-	64	7	0.1	0.6
Heptane, 2,3-dimethyl-	87	5	0.1	0.4
Cyclohexane, 1,2,4-trimethyl-, (1.alpha.,2.beta.,4.beta.)-	93	5	0.1	0.4
Heptane, 2,5-dimethyl-	74	<5	<0.1	<0.4
Total**		213	3.4	18.0

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LABORATORY ANALYSIS REPORT

EC>10-EC12 Aliphatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*	µgm ⁻³ *
	Quality Match				
Undecane	83		29	0.5	2.9
Decane, 2-methyl-	58		13	0.2	1.3
Decane, 4-methyl-	68		12	0.2	1.2
Dodecane	96		6	0.1	0.7
Total**			61	1.0	6.1

EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*
	Quality Match			
			<5	<0.1

EC5-EC7 Aromatic Hydrocarbons** (Benzene)

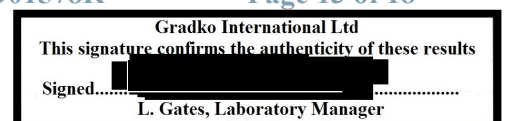
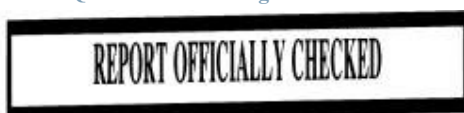
EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

EC>8-EC10 Aromatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*	µgm ⁻³ *
	Quality Match				
Benzene, 1-ethyl-2-methyl-	42		10	0.2	0.8
Benzene, 1,3,5-trimethyl-	94		6	0.1	0.4
Benzene, (1-methylethyl)-	43		<5	<0.1	<0.4
			21	0.3	1.6

EC>10-EC12 Aromatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*	µgm ⁻³ *
	Quality Match				
Naphthalene	95		35	0.6	2.8
Indane	94		18	0.3	1.3
Benzene, 1,2,3-trimethyl-	81		10	0.2	0.8
Benzene, 1-ethyl-2,3-dimethyl-	53		6	0.1	0.5
Total**			69	1.1	5.5

EC>12-EC16 Aromatic Hydrocarbons**	NIST Library		Estimated ng on tube	ppb in air*
	Quality Match			
			<5	<0.1

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LABORATORY ANALYSIS REPORT

Tube Number 004507
Gradko Lab Reference 08O0219
Exposure Time (mins)* 31536
Sample ID V8

BTEX	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	6.3	0.3	0.9
Toluene	8.5	0.3	1.0
Ethylbenzene	<5	<0.1	<0.5
m/p-Xylene	<5	<0.1	<0.5
o-Xylene	<5	<0.1	<0.5

EC6-EC8 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Cyclohexane, methyl-	93	6	0.1	0.4
Cyclopentane, methyl-	68	6	0.1	0.3
Pentane, 2,3,3-trimethyl-	47	6	0.1	0.4
Total**		18	0.3	1.1

EC>8-EC10 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Decane	93	19	0.3	1.7
Cyclohexane, 1-ethyl-2-methyl-	83	6	0.1	0.4
Cyclohexane, 1,1,3-trimethyl-	78	<5	<0.1	<0.4
Total**		29	0.5	2.5

EC>10-EC12 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*	µgm ⁻³ *
Undecane	92	21	0.3	2.1

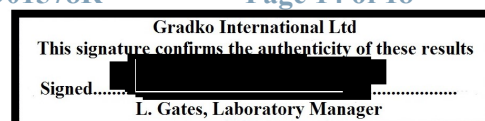
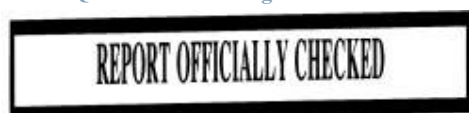
EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*
		<5	<0.1

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

EC>8-EC10 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube	ppb in air*
		<5	<0.1

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EC>10-EC12 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5	ppb in air* <0.1	
EC>12-EC16 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5	ppb in air* <0.1	
Tube Number	004516			
Gradko Lab Reference	08O0220			
Exposure Time (mins)*	31513			
Sample ID	External			
BTEX		ng on tube	ppb in air*	µgm⁻³*
Benzene		7.1	0.3	1.0
Toluene		7.9	0.2	0.9
Ethylbenzene		<5	<0.1	<0.5
m/p-Xylene		<5	<0.1	<0.5
o-Xylene		<5	<0.1	<0.5
EC6-EC8 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5	ppb in air* <0.1	
EC>8-EC10 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5	ppb in air* <0.1	
EC>10-EC12 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5	ppb in air* <0.1	
EC>12-EC16 Aliphatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5	ppb in air* <0.1	
EC5-EC7 Aromatic Hydrocarbons**				(Benzenze)
EC>7-EC8 Aromatic Hydrocarbons**				(Toluene)

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EC>8-EC10 Aromatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*
	<5	<0.1

EC>10-EC12 Aromatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*
	<5	<0.1

EC>12-EC16 Aromatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube	ppb in air*
	<5	<0.1

Tube Number	004549
Gradko Lab Reference	08O0221
Sample ID	Blank

BTEX	ng on tube
Benzene	<5
Toluene	5.5
Ethylbenzene	<5
m/p-Xylene	<5
o-Xylene	<5

EC6-EC8 Aliphatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube
	<5

Hexane

EC>8-EC10 Aliphatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube
	<5

EC>10-EC12 Aliphatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube
	<5

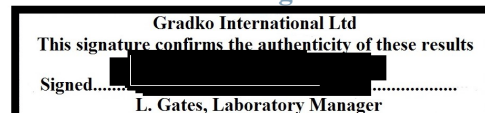
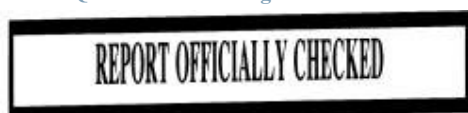
EC>12-EC16 Aliphatic Hydrocarbons**

NIST Library Quality Match	Estimated ng on tube
	<5

EC5-EC7 Aromatic Hydrocarbons** (Benzenze)

EC>7-EC8 Aromatic Hydrocarbons** (Toluene)

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EC>8-EC10 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5
EC>10-EC12 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5
EC>12-EC16 Aromatic Hydrocarbons**	NIST Library Quality Match	Estimated ng on tube <5

Uptake Rates:

Benzene 0.70 ng.ppm⁻¹.min⁻¹.

Toluene 1.03 ng.ppm⁻¹.min⁻¹.

Ethylbenzene 1.46 ng.ppm⁻¹.min⁻¹.

m/p Xylene 1.46 ng.ppm⁻¹.min⁻¹.

o-Xylene 1.46 ng.ppm⁻¹.min⁻¹.

All other compounds: 2.00 ng.ppm⁻¹.min⁻¹.

Results are not Blank corrected.

Results greater than 1000ng are outside of our UKAS accredited calibration range.

Reporting Limit

5ng on tube

Results reported as <5ng on tube are below the reporting limit.

Estimated results reported as <5ng on tube are below the reporting limit for the non-specific standard toluene.

Measurement Uncertainty BTEX compounds

±16.3%

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Estimated results as ng on tube are calculated by reference to toluene in accordance with ISO 16000-6

Compounds reported may not be the most abundant detected in these samples.

**The classification and grouping of TPH compounds to CWG guidelines is not covered by our UKAS accreditation.

Identification of compounds is carried out by comparison of the mass spectra to the NIST 17 mass spectral library. Compounds with a quality match below 85% are noted as a tentative identity and shown in italics. These compounds are outside of the scope of our UKAS accreditation.

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LABORATORY ANALYSIS REPORT

Where a result is shown as less than the reporting limit the reporting limit concentration is included in the total TPH result.

If the sum of results below the reporting limit is greater than the sum of results above the reporting limit total TPH will be reported as less than the value reported.

Analysts Name	Katya Paldamova	Date of Analysis	27/02/2020
Report Checked By	Mariella Angelova	Date of Report	06/03/2020

Analysis has been carried out in accordance with in-house method GLM 13

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APPENDIX B

CLEA Input Values

Building		
Building Footprint (m ²)	57	Building footprint of the smallest apartment assessed (Plot 875) - information provided by Dorchester Living
Living space air exchange rate (hr)	0.5	CLEA SR3 Default Building Parameters (residential)
Living space height above ground (m)	2.4	Living space height of Phase 5c ground floor apartments - information provided by Dorchester Living
Living space height below ground (m)	0	No cellars/underground rooms
Pressure difference (Pa)	3.1	CLEA SR3 Default Building Parameters (all residential other than bungalow; used in absence of data for apartments)
Foundation thickness (m)	0.075	Minimum specified thickness of C30 concrete topping overlying block and beam foundation construction - information provided by Dorchester Living
Floor Crack Area (cm ²)	706.5	CLEA SR3 Default Building Parameters for bungalow (largest floor crack area of all default residential scenarios; used in absence of data for apartments)
Dust loading factor (ug m ³)	60	CLEA SR3
Default soil gas ingress rate (cm ³ s)	25	CLEA SR3
Soil		
Soil type	Sand	Assumption of sand as a worst case granular constituent
SOM Content	1.5	Site derived value (average of formation soils dataset from wider Phase 5 area)
pH	8.6	Site derived value (average of formation soils dataset from wider Phase 5 area)
Receptor (Future Site Resident)		
Critical Receptor (yrs)	0-6	CLEA SR3 Default Residential Land Use (Age Cass 1-6)
Body Mass (kg)	13.3	CLEA SR3 Default Residential Land Use (Age Cass 1-6 averaged)
Exposure Duration (yrs)	6	CLEA SR3 Default Residential Land Use Exposure Duration
Exposure Frequency (days)	2190	CLEA SR3 Default Residential Land Use Exposure Frequency
Inhalation Rate Indoors (m ³ /d)	11.85	CLEA SR3 Default Residential Land Use (Age Cass 1-6 averaged)
Time indoors (hrs)	21.6	CLEA SR3 Default Site Occupancy for age class of one to six averaged
Inhalation Rate Outdoors (m ³ /d)	1.3	CLEA SR3 assumes high intensive activity over age class 1-6 averaged, assuming 1 hour outdoors per day
Time Outdoors (hrs)	1	CLEA SR3 Default Residential Land Use (Age Cass 1-6 averaged)

Benzene

Parameters: Benzene		
Parameter	Input Value	Notes/Source
Oral HCV (ug kg BW day)	0.29	LQM/CIEH S4UL (2015)
Inhal HCV (ug kg BW day)	1.4	LQM/CIEH S4UL (2015)
Oral MDI (ug day)	NA	LQM/CIEH S4UL (2015)
Inhalation MDI (ug day)	NA	LQM/CIEH S4UL (2015)
Air-Water Partition Coefficient (K_{aw})	1.16E-01	LQM/CIEH S4UL (2015)
Diffusion Coefficient in Air (m^2s)	8.77E-06	LQM/CIEH S4UL (2015)
Diffusion Coefficient in Water (m^2s)	6.64E-10	LQM/CIEH S4UL (2015)
Relative Molecular Mass (g mol)	78.11	LQM/CIEH S4UL (2015)
Vapour Pressure (Pa)	6.24E+03	LQM/CIEH S4UL (2015)
Water Solubility (mg/l)	1.78E+03	LQM/CIEH S4UL (2015)
Log Organic Carbon - Water Partition Coefficient (K_{oc})	1.83	LQM/CIEH S4UL (2015)
Log Octanol-Water Partition Coefficient (K_{ow})	2.13	LQM/CIEH S4UL (2015)
Dermal Absorption Fraction	0.1	LQM/CIEH S4UL (2015)
Soil to dust transport factor (g g dry weight)	0.5	LQM/CIEH S4UL (2015)
sub-surface soil to indoor air correction factor	10	LQM/CIEH S4UL (2015)

Aliphatic Hydrocarbons EC8-10

Parameters: Aliphatic Hydrocarbons EC8-10		
Parameter	Input Value	Notes/Source
Oral HCV (ug kg BW day) - TDI	100	LQM/CIEH S4UL (2015) - TDI
Inhal HCV (ug kg BW day) - TDI	290	LQM/CIEH S4UL (2015) - TDI
Oral MDI (ug day)	9.99E+99	LQM/CIEH S4UL (2015)
Inhalation MDI (ug day)	9.99E+99	LQM/CIEH S4UL (2015)
Air-Water Partition Coefficient (K_{aw})	4.15E+01	LQM/CIEH S4UL (2015)
Diffusion Coefficient in Air (m^2s)	1.00E-05	LQM/CIEH S4UL (2015)
Diffusion Coefficient in Water (m^2s)	1.00E-09	LQM/CIEH S4UL (2015)
Relative Molecular Mass (g mol)	130	LQM/CIEH S4UL (2015)
Vapour Pressure (Pa)	3.20E+02	LQM/CIEH S4UL (2015)
Water Solubility (mg/l)	4.27E-01	LQM/CIEH S4UL (2015)
Log Organic Carbon - Water Partition Coefficient (K_{oc})	4.48	LQM/CIEH S4UL (2015)
Log Octanol-Water Partition Coefficient (K_{ow})	5.22	LQM/CIEH S4UL (2015)
Dermal Absorption Fraction	0.1	LQM/CIEH S4UL (2015)
Soil to dust transport factor (g g dry weight)	0.5	LQM/CIEH S4UL (2015)
sub-surface soil to indoor air correction factor	10	LQM/CIEH S4UL (2015)

Aliphatic Hydrocarbons EC10-12

Parameters: Aliphatic Hydrocarbons EC10-12		
Parameter	Input Value	Notes/Source
Oral HCV (ug kg BW day) - TDI	100	LQM/CIEH S4UL (2015) - TDI
Inhal HCV (ug kg BW day) - TDI	290	LQM/CIEH S4UL (2015) - TDI
Oral MDI (ug day)	9.99E+99	LQM/CIEH S4UL (2015)
Inhalation MDI (ug day)	9.99E+99	LQM/CIEH S4UL (2015)
Air-Water Partition Coefficient (K_{aw})	6.44E+01	LQM/CIEH S4UL (2015)
Diffusion Coefficient in Air (m^2s)	1.00E-05	LQM/CIEH S4UL (2015)
Diffusion Coefficient in Water (m^2s)	1.00E-09	LQM/CIEH S4UL (2015)
Relative Molecular Mass (g mol)	160	LQM/CIEH S4UL (2015)
Vapour Pressure (Pa)	3.21E+01	LQM/CIEH S4UL (2015)
Water Solubility (mg/l)	3.39E-02	LQM/CIEH S4UL (2015)
Log Organic Carbon - Water Partition Coefficient (K_{oc})	5.38	LQM/CIEH S4UL (2015)
Log Octanol-Water Partition Coefficient (K_{ow})	6.3	LQM/CIEH S4UL (2015)
Dermal Absorption Fraction	0.1	LQM/CIEH S4UL (2015)
Soil to dust transport factor (g g dry weight)	0.5	LQM/CIEH S4UL (2015)
sub-surface soil to indoor air correction factor	10	LQM/CIEH S4UL (2015)

Report generated 13/02/2015
 Report title R1742d-R01-v1
 Created by Scott Miller at Smith Grant LLP



BASIC SETTINGS

Land Use Residential with produce
 Building DL Ph5c Apartment 875
 Receptor Female (res) Start age class 1 End age class 6 Exposure Duration 6 years
 Soil Sand

Exposure Pathways

Direct soil and dust ingestion	<input checked="" type="checkbox"/>	Dermal contact with indoor dust	<input checked="" type="checkbox"/>	Inhalation of indoor dust	<input checked="" type="checkbox"/>
Consumption of homegrown produce	<input checked="" type="checkbox"/>	Dermal contact with soil	<input checked="" type="checkbox"/>	Inhalation of soil dust	<input checked="" type="checkbox"/>
Soil attached to homegrown produce	<input checked="" type="checkbox"/>			Inhalation of indoor vapour	<input checked="" type="checkbox"/>
				Inhalation of outdoor vapour	<input checked="" type="checkbox"/>



Land Use Residential with produce

Receptor Female (res)

Age Class	Exposure Frequencies (days yr ⁻¹)						Occupation Periods (hr day ⁻¹)		Soil to skin adherence factors (mg cm ⁻²)		Direct soil ingestion rate (g day ⁻¹)	Body weight (kg)	Body height (m)	Inhalation rate (m ³ day ⁻¹)	Max exposed skin factor		
	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with indoor dust	Dermal contact with soil	Inhalation of dust and vapour, indoor	Inhalation of dust and vapour, outdoor	Indoors	Outdoors	Indoor	Outdoor					Indoor (m ² m ⁻²)	Outdoor (m ² m ⁻²)	Total skin area (m ²)
1	180	180	180	180	365	365	23.0	1.0	0.06	1.00	0.10	5.60	0.7	8.5	0.32	0.26	3.43E-01
2	365	365	365	365	365	365	23.0	1.0	0.06	1.00	0.10	9.80	0.8	13.3	0.33	0.26	4.84E-01
3	365	365	365	365	365	365	23.0	1.0	0.06	1.00	0.10	12.70	0.9	12.7	0.32	0.25	5.82E-01
4	365	365	365	365	365	365	23.0	1.0	0.06	1.00	0.10	15.10	0.9	12.2	0.35	0.28	6.36E-01
5	365	365	365	365	365	365	19.0	1.0	0.06	1.00	0.10	16.90	1.0	12.2	0.35	0.28	7.04E-01
6	365	365	365	365	365	365	19.0	1.0	0.06	1.00	0.10	19.70	1.1	12.2	0.33	0.26	7.94E-01
7	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	22.10	1.2	12.4	0.22	0.15	8.73E-01
8	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	25.30	1.2	12.4	0.22	0.15	9.36E-01
9	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	27.50	1.3	12.4	0.22	0.15	1.01E+00
10	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	31.40	1.3	12.4	0.22	0.15	1.08E+00
11	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	35.70	1.4	12.4	0.22	0.14	1.19E+00
12	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	41.30	1.4	13.4	0.22	0.14	1.29E+00
13	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	47.20	1.5	13.4	0.22	0.14	1.42E+00
14	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	51.20	1.6	13.4	0.22	0.14	1.52E+00
15	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	56.70	1.6	13.4	0.21	0.14	1.60E+00
16	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	59.00	1.6	13.4	0.21	0.14	1.63E+00
17	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	70.00	1.6	14.8	0.33	0.27	1.78E+00
18	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	70.90	1.6	12.0	0.33	0.27	1.80E+00

Consumption Rates



Consumption rates (g FW kg⁻¹ bodyweight day⁻¹) by Produce Group

Age Class	MEAN RATES						90TH PERCENTILE RATES					
	Green veg	Root veg	Tuber veg	Herb. Fruit	Shrub fruit	Tree fruit	Green veg	Root veg	Tuber veg	Herb. Fruit	Shrub fruit	Tree fruit
1							7.12E+00	1.07E+01	1.60E+01	1.83E+00	2.23E+00	3.82E+00
2							6.85E+00	3.30E+00	5.46E+00	3.96E+00	5.40E-01	1.20E+01
3							6.85E+00	3.30E+00	5.46E+00	3.96E+00	5.40E-01	1.20E+01
4							6.85E+00	3.30E+00	5.46E+00	3.96E+00	5.40E-01	1.20E+01
5							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
6							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
7							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
8							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
9							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
10							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
11							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
12							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
13							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
14							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
15							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
16							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
17							2.94E+00	1.40E+00	1.79E+00	1.61E+00	2.20E-01	2.97E+00
18							2.94E+00	1.40E+00	1.79E+00	1.61E+00	2.20E-01	2.97E+00

Top 2 applied? No

Where top 2 method is applied, two produce categories use 90th percentile rates, while the remainder use the mean. Produce categories vary on a chemical-by-chemical basis. Where top 2 method is not used, all produce categories for all chemicals assume 90th percentile rates.

Building DL Ph5c Apartment 875**Soil** Sand

Building footprint (m ²)	5.70E+01	Porosity, Total (cm ³ cm ⁻³)	5.40E-01
Living space air exchange rate (hr ⁻¹)	5.00E-01	Porosity, Air-Filled (cm ³ cm ⁻³)	3.00E-01
Living space height (above ground, m)	2.40E+00	Porosity, Water-Filled (cm ³ cm ⁻³)	2.40E-01
Living space height (below ground, m)	0.00E+00	Residual soil water content (cm ³ cm ⁻³)	7.00E-02
Pressure difference (soil to enclosed space, Pa)	3.10E+00	Saturated hydraulic conductivity (cm s ⁻¹)	7.36E-03
Foundation thickness (m)	7.50E-02	van Genuchten shape parameter <i>m</i> (dimensionless)	3.51E-01
Floor crack area (cm ²)	7.07E+02	Bulk density (g cm ⁻³)	1.18E+00
Dust loading factor (µg m ⁻³)	6.00E+01	Threshold value of wind speed at 10m (m s ⁻¹)	7.20E+00
		Empirical function (F _x) for dust model (dimensionless)	1.22E+00
		Ambient soil temperature (K)	2.83E+02
		Soil pH	8.60E+00
		Soil Organic Matter content (%)	1.50E+00
		Fraction of organic carbon (g g ⁻¹)	8.70E-03
		Effective total fluid saturation (unitless)	3.62E-01
		Intrinsic soil permeability (cm ²)	9.83E-08
		Relative soil air permeability (unitless)	7.68E-01
		Effective air permeability (cm ²)	7.54E-08

Soil - Vapour Model

Depth to top of source (no building) (cm)	0
Depth to top of source (beneath building) (cm)	57.5
Default soil gas ingress rate?	Yes
Soil gas ingress rate (cm ³ s ⁻¹)	2.50E+01
Building ventilation rate (cm ³ s ⁻¹)	1.90E+04
Averaging time surface emissions (yr)	6
Finite vapour source model?	No
Thickness of contaminated layer (cm)	200

Air Dispersion Model

Mean annual windspeed at 10m (m s ⁻¹)	5.00
Air dispersion factor at height of 0.8m *	2400.00
Air dispersion factor at height of 1.6m *	0.00
Fraction of site cover (m ² m ⁻²)	0.75

* Air dispersion factor in g m⁻² s⁻¹ per kg m⁻³**Soil - Plant Model**

	Dry weight conversion factor	Homegrown fraction		Soil loading factor	Preparation correction factor
	g DW g ⁻¹ FW	Average	High		
		dimensionless		g g ⁻¹ DW	dimensionless
Green vegetables	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	0.103	0.06	0.40	1.00E-03	1.00E+00
Tuber vegetables	0.210	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	0.058	0.06	0.40	1.00E-03	6.00E-01
Shrub fruit	0.166	0.09	0.60	1.00E-03	6.00E-01
Tree fruit	0.157	0.04	0.27	1.00E-03	6.00E-01

Gardener type Average

APPENDIX C

CLEA Derived Indoor Vapour Concentrations

CLEA Software Version 1.071

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Report generated 13-Feb-15

Report title R1742d-R01-v1

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Environment
Agency

RESULTS



	Average Daily Exposure (mg kg ⁻¹ bw day ⁻¹)							Distribution by Pathway (%)							
	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															

