

SUMMARY OF ASSESSMENT AND COMPLIANCE

This section provides a summary of the assessment conclusions; readers should refer to the later sections of this Certificate for information about the assessments carried out.

Compliance with Regulations

Having assessed the key factors, the opinion of the BBA is that Toughsheet Radon Barrier, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations:



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	C1(2)	Site preparation and resistance to contaminants
Comment:		The product can contribute to satisfying this Requirement. See section 3 of this Certificate.
Requirement:	C2(a)	Resistance to moisture
Comment:		The product, including joints, will enable a floor to satisfy this Requirement. See section 3 of this Certificate.
Regulation:	7(1)	Materials and workmanship
Comment:		The product is acceptable. See sections 8 and 9 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Fitness and durability of materials and workmanship
Comment:		The product is acceptable. See sections 8 and 9 of this Certificate.
Regulation:	9	Building standards - construction
Standard:	3.2	Site preparation — protection from radon gas The product will contribute to satisfying this Standard, with reference to clause 3.2.2 ⁽¹⁾⁽²⁾ . See section 3 of this Certificate.
Standard:	3.4	Moisture from the ground
Comment:		The product will enable a structure to satisfy this Standard, with reference to clauses 3.4.1 ⁽¹⁾⁽²⁾ , 3.4.2 ⁽¹⁾⁽²⁾ and 3.4.5 ⁽¹⁾⁽²⁾ to 3.4.7 ⁽¹⁾⁽²⁾ . See section 3 of this Certificate.
Standard:	7.1(a)	Statement of sustainability
Comment:		The product can contribute to meeting the relevant Requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	12	Building standards - conversion
Comment:		All comments given for the product under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ . (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	23(1)(a)(i)	Fitness of materials and workmanship
Comment:	(iii)(b)(i)	The product is acceptable. See sections 8 and 9 of this Certificate.
Regulation:	26(1)(b)(2)	Site preparation and resistance to contaminants
Comment:		The product can contribute to satisfying this Regulation. See section 3 of this Certificate.

Regulation:	28(a)	Resistance to moisture and weather
Comment:	The product can contribute to satisfying this Regulation. See section 3 of this Certificate.	

Fulfilment of Requirements

The BBA has judged Toughsheet Radon Barrier to be satisfactory for use as described in this Certificate. The product has been assessed as a LDPE radon barrier and DPM for use in concrete ground floors above and below slabs not subject to hydrostatic pressure, to protect the building against moisture and radon from the ground.

ASSESSMENT

Product description and intended use

The Certificate holder provided the following description for the product under assessment. Toughsheet Radon Barrier comprises a blown film of extruded recycled LDPE.

The product has the nominal characteristics given in Table 1.

<i>Table 1 Nominal characteristics</i>		
Characteristic (unit)	Value	
Thickness (mm)	0.4	0.5
Width (m)	4	4
Roll length (m)	20	12.5
Colour	Yellow	Yellow

Ancillary Items

The Certificate holder recommends the following ancillary items for use with the product, but these materials have not been assessed by the BBA and are outside the scope of this Certificate:

- double sided butyl tape – for use in joints and laps
- jointing tape – for securing laps and joints.

Applications

Toughsheet Radon Barriers are suitable for use in concrete floors not subject to hydrostatic pressure, in accordance with the relevant clauses of CP 102 : 1973.

The product can be installed as an oversite membrane, between a blinded hardcore bed and the base concrete slab, as a sandwich membrane in a base concrete slab, or between a base concrete slab and a screed.

The product can also be used in suspended floor constructions.

Definitions for products and applications inspected

A gas-resistant membrane is defined for the purpose of this Certificate as a membrane placed above, below or within the floor slab construction to restrict methane and carbon dioxide migration from the ground into a building (as defined in BS 8485 : 2015).

Product assessment – key factors

The product was assessed for the following key factors, and the outcome of the assessment is shown below. Conclusions relating to the Building Regulations apply to the whole of the UK unless otherwise stated.

1 Mechanical resistance and stability

Data were assessed for the following characteristics.

1.1 Mechanical properties

1.1.1 Trouser tear, nail tear, tensile strength, elongation, resistance to impact, dart impact and low temperature flexibility were assessed using test data for representative related products.

1.1.2 On the basis of data assessed, the product can be punctured by sharp objects and care must be taken when handling building materials and equipment over the exposed surface.

1.1.3 The product remains flexible in the extremes of temperature likely to occur in practice.

2 Safety in case of fire

Not applicable.

3 Hygiene, health and the environment

Data were assessed for the following characteristics.

3.1 Resistance to water and water vapour

3.1.1 Water vapour transmission properties, tensile shear strength of joints and airtightness of joints were assessed on the basis of existing data for a representative related product.

3.1.2 On the basis of the data assessed, the product, including joints, provides an effective barrier to the passage of water vapour from the ground. The product is impervious to water and provides a waterproof layer capable of accepting minor structural movements without damage.

3.2 Resistance to underground gases

3.2.1 Results of tests for resistance to underground gases are given in Table 2.

Table 2 Resistance to underground gases

Product assessed	Assessment method	Requirement	Result
Toughsheet Radon 400 Membrane	Radon diffusion coefficient to ISO/TS 11665-13 : 2017	Value achieved	$7.4 \times 10^{-12} \text{ m}^2 \cdot \text{s}^{-1}$
A representative related product jointed with, double sided butyl tape, jointing tape	Radon permeability to ISO/DIS 11665-10 : 2012 method C (K124/02/95)	Value achieved	$4.0 \times 10^{-12} \text{ m}^2 \cdot \text{s}^{-1}$

3.2.2 On the basis of data assessed, the product will restrict the ingress of radon into buildings from naturally occurring sources.

3.2.3 The product complies with the minimum sheet thickness for polyethylene DPMs detailed in the documents supporting the national Building Regulations.

4 Safety and accessibility in use

Not applicable.

5 Protection against noise

Not applicable.

6 Energy economy and heat retention

Not applicable.

7 Sustainable use of natural resources

The membranes comprise polyethylene, which can be recycled.

8 Durability

8.1 The potential mechanisms for degradation and the known performance characteristics of the materials in the product were assessed.

8.2 Resistance to heat ageing for trouser tear, nail tear, tensile strength and elongation were assessed using test data for a representative related product.

8.3 The effect of short term UV ageing on tensile strength and elongation were assessed using test data for a representative related product.

8.4 Dimensional stability was assessed using test data for a representative related product.

8.5 Service life

8.5.1 Under normal service conditions, the product, when fully protected, will have a life of the structure in which it is incorporated, provided it is designed, installed and maintained in accordance with this Certificate and the Certificate holder's instructions.

8.5.2 The product will not be significantly affected by short-term exposure to ultraviolet (UV) light. However, it must be protected as soon as practicable after installation.

PROCESS ASSESSMENT

Information provided by the Certificate holder was assessed for the following factors:

9 Design, installation, workmanship and maintenance

9.1 Design

9.1.1 The design process was assessed against the requirements of BS 8000-4 : 1989, BS 8485 : 2015, CP 102 : 1973 Section 3, this Certificate and the Certificate holder's instructions, and the following requirements apply in order to satisfy the performance assessed in this Certificate.

9.1.2 The design of a gas protection system must be carried out by a suitably experienced and competent individual with sufficient knowledge of ground gas risk and the construction methods and materials.

9.1.3 The continuity of the gas protection must extend over the footprint of the building, and the product must be sealed to a gas-resistant damp-proof course (DPC) where applicable.

9.1.4 On ground bearing slabs, unless the base is smooth, a surface blinding of soft sand or similar material must be used to prevent puncturing during installation or when the concrete or screed is being placed.

9.1.5 The product can be installed in all conditions normal to ground-floor slab construction. Where there is a risk of ground becoming waterlogged, sub-soil drainage must be provided in accordance with CP 102 : 1973.

9.1.6 The type of floor finish to be used may limit the suitability of a polyethylene DPM. The guidance given in CP 102 : 1973 must be followed.

9.1.7 There will be no adverse effect on the product from the underfloor heating under normal service conditions. In other circumstances, the Certificate holder's advice must be sought, but such advice is outside the scope of this Certificate.

9.2 Installation

9.2.1 Installation instructions provided by the Certificate holder were assessed and judged to be appropriate and adequate.

9.2.2 Installation must be carried out in accordance with this Certificate and the Certificate holder's instructions following the relevant guidance in BRE Report BR 211 : 2023, CP 102 : 1973, BS 8000-0 : 2014, BS 8000-4 : 1989 BS 8485 : 2015 and NHBC NF 94.

9.2.3 The product must only be applied to surfaces that have a smooth finish, ie they should be free from voids, projections and mortar deposits. Surfaces should be dry and free from dust and frost.

9.2.4 Concrete surfaces should be dense. Vertical surfaces of brickwork and blockwork must be dry and rendered to provide an even surface. Brickwork or blockwork not rendered must be flush pointed to give a smooth surface without sudden changes in level.

9.2.5 All gas membrane installations must be subject to third-party independent validation, in accordance with BS 8485 : 2015.

9.2.6 On suspended floor slabs, the area must be free of debris and projections that may damage the product.

9.2.7 All surfaces must be dried thoroughly prior to application of the double sided butyl tape. A strip of the tape is unrolled over the membrane with its nearest edge 50 mm from the membrane edge. The protective paper is removed from the double sided butyl tape prior to rolling an adjacent run of the membrane, which must be carefully unrolled over the jointing tape, ensuring a 100 mm overlap.

9.2.8 The product must be continuous with the DPC in the surrounding walls. Where necessary the membrane must be used as a vertical DPC to link the two. The DPM and the DPC joint must be overlapped by a minimum of 150 mm and sealed with an appropriate sealant tape. Where there is doubt about the compatibility of materials, the advice of the Certificate holder must be sought, however such advice is outside the scope of this Certificate.

9.2.9 The product must be covered by a screed or other protective layer as soon as possible after installation. Care must be taken to ensure that the product is not stretched or displaced when placing the concrete or screed over the product. Sufficient allowance must be made to avoid bridging (ie creating areas of unsupported membrane) during screeding operations at details such as internal angles.

9.2.10 When the membrane is laid below the concrete slab, it should be loose-laid to accommodate any small movements.

9.2.11 All service penetrations and direction changes must be properly detailed in accordance with the Certificate holder's instructions. Service ducts must be vented to prevent the possibility of gas accumulating in confined spaces.

9.2.12 The continuity of the gas protection must extend over the footprint of the building and the gas membrane must be sealed to a gas-resistant DPC.

9.3 Workmanship

9.3.1 Practicability of installation was assessed against BS 8485 : 2015, on the basis of the Certificate holder's information. To achieve the performance described in this Certificate, installation of the product must be carried out by installers trained by the Certificate holder.

9.3.2 The BBA operates an Approved Installer Scheme for gas membranes; details of approved installer companies are included on the BBA website (www.bbacerts.co.uk).

9.4 Maintenance and repair

9.4.1 As the product is confined within the structure and has suitable durability, maintenance is not required. However, and damage occurring before enclosure must be remained.

9.4.2 Any damage to the product must be repaired using a patch of the product, and laps are sealed using tape.

10 **Manufacture**

10.1 The production processes for the product have been assessed, and provide assurance that the quality controls are satisfactory according to the following factors:

10.1.1 The manufacturer has provided documented information on the materials, processes, testing and control factors.

10.1.2 The quality control operated over batches of incoming materials has been assessed and deemed appropriate and adequate.

10.1.3 The quality control procedures and product testing to be undertaken have been assessed and deemed appropriate and adequate.

10.1.4 The process for management of non-conformities has been assessed and deemed appropriate and adequate. An audit of each production location was undertaken, and it was confirmed that the production process was in accordance with the documented process, and that equipment has been properly tested and calibrated.

10.1.5 An audit of each production location was undertaken, and it was confirmed that the production process was in accordance with the documented process, and that equipment has been properly tested and calibrated.

† 10.2 The BBA has undertaken to review the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

11 **Delivery and site handling**

11.1 The Certificate holder stated that rolls of the product are delivered to site packed in wrappers bearing labels with the product name and the BBA logo incorporating the number of this Certificate. Rolls are supplied shrink-wrapped and on pallets.

11.2 Delivery and site handling must be performed in accordance with the Certificate holder's instructions and this Certificate, including:

11.2.1 Rolls must be stored under cover on the original pallet or individually, on end.

ANNEX A – SUPPLEMENTARY INFORMATION †

Supporting information in this Annex is relevant to the product but has not formed part of the material assessed for the Certificate.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

UKCA marking

The Certificate holder has taken the responsibility of UKCA marking the product in accordance with Designated Standard EN 13967 : 2012.

CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with harmonised European Standard BS EN 13967 : 2012.

Management Systems Certification for production

The management system of the manufacturer has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by ISOQAR (Certificate 2092 QM-001).

Bibliography

- BRE Report BR 211 : 2023 *Radon: Guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)*
- BS 8000-0 : 2014 + A1 : 2024 *Workmanship on construction sites – Introduction and general principles*
- BS 8000-4 : 1989 *Workmanship on building sites – Code of practice for waterproofing*
- BS 8485 : 2015 + A1 : 2019 *Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings*
- BS EN 13967 : 2012 + A1:2017 *Flexible sheets for waterproofing – Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet – Definitions and characteristics*
- BS EN ISO 9001 : 2015 *Quality management systems – Requirements*
- CP 102 : 1973 *Code of practice for protection of buildings against water from the ground*
- ISO/DIS 11665-10 : 2012 *method C (K124/02/95) Measurement of radioactivity in the environment — Air: radon-222 - Part 10: Determination of diffusion coefficient in waterproof materials using activity concentration measurement*
- ISO/TS 11665-13 : 2017 *Measurement of radioactivity in the environment — Air: radon 222 Part 13: Determination of the diffusion coefficient in waterproof materials: membrane two-side activity concentration test method*

Conditions

1 This Certificate:

- relates only to the product that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

3 This Certificate will be displayed on the BBA website, and the Certificate Holder is entitled to use the Certificate and Certificate logo, provided that the product and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product or any other product
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product
- actual installations of the product, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to UKCA marking and CE marking.

6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product which is contained or referred to in this Certificate is the minimum required to be met when the product is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

Declaration Of Performance- Cert 99/3603

Toughsheet Radon/ Gas Barrier- EN31967

1: Usage

400/500 micron flexible sheeting to be used for water proofing and gas control in solid concrete floors that are not subject to hydrostatic pressure from the ground.

2: Specification

CFS - 2MT/4MT x 20MTS x 400 Micron

CFS - 2MT/4MT x 12.5M x 500 Micron

Thickness- EN12311	400mu Amber1	500mu Amber2
Length- 1848-2	20MTS - 0 + 5%	12.5MTS - 0 + 5%
Width- 1842-2	4MT - 0 + 10%	4MT - 0 + 10%
Drop Dart- EN12691	30 MLV	30 MLV
Water Tightness	BBA Pass	BBA Pass
Static Loading	BBA Pass	BBA Pass
Durability/Aged	BBA Pass	BBA Pass
Mass- BBA Test	368 MLV	460 MLV

3: Gas Transmission Rate- 2015

Versaperm Permeability Laboratory Test Reports 21/09/22 Report Number LR2465B						
Trade Name/ Identification	Nominal Thickness	Gas	Permeation Rate cm ³ (STP).mm/m ² .d.atm			
			1	2	3	Mean
<u>Toughsheet Yellow</u> 400 Micron	440	CO ₂	150	152	151	151.0
<u>Toughsheet Yellow</u> 400 Micron	440	Methane	35	36	35	35.3

CZECH TECHNICAL UNIVERSITY IN PRAGUE FACULTY OF CIVIL ENGINEERING – TEST LABORATORY Test laboratory No. 1048 accredited by ČIA according to ČSN EN ISO/IEC 17025:2018 Thákurova 7, 166 29 Praha 6	Issue No.: 1 Page No.: 3 Report No: 124002/2022 Date of issue: 11.1.2022
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4: Test Results

The resulting values of the radon diffusion coefficient, the radon diffusion length and the radon resistance included expanded measurement uncertainty, are listed in the following table. The results refer to the samples as they were taken over.

TESTED MATERIAL		Radon Barrier 400
RN DIFFUSION COEFFICIENT D (m ² /s)	mean value	$7,4 \cdot 10^{-12}$
	$\pm U$	$\pm 0,9 \cdot 10^{-12}$
RN DIFFUSION LENGTH l (m)	mean value	$1,9 \cdot 10^{-3}$
	$\pm U$	$\pm 0,2 \cdot 10^{-3}$
RN RESISTANCE R_{Rn} (Ms/m)	mean value	51,7
	$\pm U$	$\pm 6,2$

The expanded uncertainties of measurement $\pm U$ mentioned are the product of standard measurement uncertainties and the expansion coefficient $k = 2$, which provides a confidence interval of approx. 95 %. The radon diffusion length was calculated according to the equation $l = \sqrt{D/\lambda}$ and the radon resistance as follows: $R_{Rn} = \frac{\sinh(d/l)}{\lambda \cdot l}$, where $\lambda = 2,1 \cdot 10^{-6} \text{ s}^{-1}$ and $d = 0,39 \text{ mm} = 0,39 \cdot 10^{-3} \text{ m}$.

This test was performed by Prof. Ing. Martin Jiranek, CSc and Ing. Veronika Kacmarikova, PHD.

This report was prepared by Prog. Ing. Martin Jiranek, CSc.

Test regulation- ISO/TS 11665-13

Test execution date- 3.1.22 - 5.1.22

Test execution place- Laboratory OL124- D2044d

Test Samples

Test Samples were cut from the material handed by the client representative Alan Blundell on 3.1.22. The samples were registered with marks 02/22/J (1 to 3) by M. Jiranek. The dimensions of the samples were 135 x 325mm (effective area 293.10 to the power of -4 m2) and their thickness was 0.39mm.

Test Methods

Radon diffusion coefficient was determined according to the method A of ISO/TS 11665-13. The tested samples were placed between the source and the receiver containers. Radon diffuses through the samples from the source container, which is connected to the radon source RF 100, to the receiver containers. Concentrations on both sides of the tested samples are measured continuously by radon detectors TSR-4 of the TERA system (receiver containers) and current mode ionization chambers (source container). Radon diffusion coefficient was derived from the process of fitting the numerical solution to the curves of radon concentration measured in the receiver containers. Numerical solution is based on the one-dimensional time-dependent diffusion equation describing radon transport through the tested material.

Laboratory Conditions

Radon Barrier 400- material

Steady state radon concentration in the source container: $1,9 \pm 0,1 \text{ MBq/m}^3$

Maximum radon concentration in the receiver containers: $36,4 \pm 0,2 \text{ kBq/m}^3$

Laboratory temperature: 22 Celcius +- 1 Celcius

Relative humidity of air in the laboratory: 39% +- 3%

Pressure difference between the lower and the upper containers: 1 Pa +- Pa

Test Device

Radon detectors TSR-4 of the TERA system (N17)

Measuring system with ionization chambers operating in current mode (N14)

Radon concentration measuring system RM-2 (N15)

Micrometer (N11)

This product must be stored flat and undercover from direct sunlight.

Certificate of factory production control- 0836-CPR-13F030.

Signed for and on behalf of manufacturer...



Accredited

Reprocessor
DOE ER199846

Valpak

2001 Challenge
Award Winner
Recycling

Signed

dated

4-4-22

Chequerbent Works
Tel: 01942 841111

• Manchester Road
• Fax: 01942 842388

• Westhoughton • Bolton BL5 3JF

• sales@toughsheet.com • www.toughsheet.com

Technical Data Sheet	Title: 0820 Black Butyl	
Effective Date: Feb 2020	Prepared By: Sam Murphy	
Issue Number: 10	Authorised By:	

Product Description

Black preformed high performance polyisobutylene (PIB) based sealing tape.

Applications

Roofing & Cladding industry where it creates an excellent seal in situations such as side and end lap joints and the bead section particularly recommended for large corrugated end lap sheet profiles.

Heating & Ventilation market has found this product to be preferable to other methods of sealing flanges on ducting due to its ease of use and solvent free formulation.

Automotive uses include sealing around the frames of sun roofs.

Greenhouse manufacturers include this product to seal between the glazing and framework.

Caravan manufacturers have many applications such as sealing between mouldings and the outer skin, lap joints on the body work and other areas where fittings are attached piercing the outer skin.

Fire Protection is enhanced by use of an intumescent version 0802FR.

Damp Proofing is used for bonding & sealing applications such as cavity trays and polythene membranes giving full Radon & Methane gas protection.

Features & Benefits

Cost effective

Non toxic

Solvent free formula

Instant seal

Direct control over quantity of sealant used in the joint

Environmentally friendly

Easy to use

No tooling required

High pumping resistance

Application notes

Should be applied to surface between +4 and +40°C temperature range, surfaces should be clean, dry and grease free. Unwind and lightly press into position leaving the release paper in place. On forming the joint the release paper is removed and the closing surface pushed firmly in place, applying even pressure along the length of the joint and mechanically fixed.

The information supplied is accurate to the best of Bruce Douglas Marketing's knowledge and is based upon all current data available to it. Properties quoted are typical and do not therefore constitute a specification. Customers must complete their own assessment of the product for its intended application under their own conditions. Our technical advice is to be regarded as an expression of opinion only and although such advice is given in good faith, it shall not, in any circumstances, be regarded as the basis of or as being a representation or statement of fact. This applies also where propriety or protective rights of third parties are involved. Any liability arising in respect of our products will be strictly limited to the value of those products charged to the customer and shall not extend to any consequential loss whatsoever and howsoever arising. This document does not form part of any contract with a customer (02/05/13)

Technical Data Sheet	Title: 0820 Black Butyl	 BRUCE DOUGLAS MARKETING
Effective Date: Feb 2020	Prepared By: Sam Murphy	
Issue Number: 10	Authorised By:	

Technical Performance

Description	Units	Value	Test Method
Total thickness	mm	1.5	Digital calliper
Life expectancy	years	20	-
UV resistance	-	excellent	-
Service temperature	°c	-40 to +90	-
Application temperatures	°c	+4 to +40	-
Joint movement	%	15	-
Dynamic shear (Std 180 grit stainless steel) Separation rate 100mm/min @ 20°C	N/cm ²	24	-
Dynamic shear (Std 180 grit stainless steel) Separation rate 200mm/min @ 20°C	N/cm ²	22	-
Moisture vapour transmission rate 24hrs/mm at 25°C & 75% RH	g/m ²	0.025	BS15106-3
Methane permeation	Methane CH4		PASS
Radon Transmission	Radon-222		PASS

Declaration of Conformity Information

Tested and approved to NFRC class "A".

Methane permeation was tested according to ISO15015-2 plastics, film and sheeting determination of gas-transmission rate – Part 2: Equal-pressure methods.

Radon transmittance was tested in accordance with SP Method no 3873.

REACH SVHC Status

NO SHVC present according to candidates list of the **UK 25/06/20 & EU 14/06/23**

RoHS Compliance Status

Not Applicable

Storage Details

Shelf life recommended 18 months from date of despatch at the moderate temperature and humidity environment.

The information supplied is accurate to the best of Bruce Douglas Marketing's knowledge and is based upon all current data available to it. Properties quoted are typical and do not therefore constitute a specification. Customers must complete their own assessment of the product for its intended application under their own conditions. Our technical advice is to be regarded as an expression of opinion only and although such advice is given in good faith, it shall not, in any circumstances, be regarded as the basis of or as being a representation or statement of fact. This applies also where propriety or protective rights of third parties are involved. Any liability arising in respect of our products will be strictly limited to the value of those products charged to the customer and shall not extend to any consequential loss whatsoever and howsoever arising. This document does not form part of any contract with a customer (02/05/13)



RADON 400

Radbar Radon 400 is manufactured from a blend of high-quality polymers, resulting in a robust membrane with high puncture resistance.

Radbar Radon 400 complies with BRE 211, UK Building Regulations and is independently certified by the BBA (Oct 1 2020).

Thickness	400µm / 1600 gauge
Width	4m
Length	20m
Colours	Red
Radon Permeability (10 ⁻¹² m ² /s)	6
Radon Transmittance (10 ⁻⁹ m/s ⁻¹)	5
Water Vapour Transmittance (g/m ² /day)	0.29
Tear Strength (Nail) (N)	>118

Accessories available from the Radbar range:

Jointing tape, double-sided and overlap tape
Top Hats, for sealing pipe penetrations
Radon Sumps
Pre-formed corners
Detailing Strip, self-adhesive for corners and penetrations
Protection Boards, for protecting the membrane post installation



sales@capitalvalleyplastics.com



01495 772255

Appendix D

MEMBRANE INSTALLAER QUALIFICATION CERTIFICATE



PART OF **nocn** GROUP

This is to certify that

Michael Farrell

has achieved the following Qualification

**NOCN_Cskills Awards Level 2 NVQ Diploma
in Sub-structure Work Occupations
(Construction) - Installation of Gas
Membranes**

Qualification Approval No: 603/1279/8
ULN: 9580061172
Award Date: 12/10/2022
Certificate No: 47917732



Graham Hasting-Evans

Graham Hasting-Evans
Chief Executive
NOCN Group



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PART OF nocn GROUP

Michael Farrell

Unit(s) Awarded

Unit Title	Unit Code	Credit(s)	Level
Conforming to General Health, Safety and Welfare in the Workplace	A/503/1170	2	L1
Moving, Handling and Storing Resources in the Workplace	F/503/1171	5	L2
Conforming to Productive Working Practices in the Workplace	J/503/1169	3	L2
Preparing to install gas membranes in the workplace	K/615/6045	15	L2
Installing gas membranes in the workplace	M/615/6046	19	L2

Qualification Approval No: 603/1279/8
ULN: 9580061172
Award Date: 12/10/2022
Certificate No: 47917732



Graham Hasting-Evans

Graham Hasting-Evans
Chief Executive
NOCN Group



ofqual
REGULATED
register.ofqual.gov.uk

Appendix E

CONTRACTOR STATEMENT

New Home Bargains Store, Docks Way, Newport, South Wales NP20 2NZ

14/01/2025

Verification report Gas Membrane Installation Contractor Statement

To whom it may concern:

In carrying out the internal slab construction. CCUL installed the gas membrane.

This was carried out to manufacturers instruction, with double sided tape between joints and single sided tape to top side.

All service penetrations had a top hat placed over them with double sided tape between the membrane and underside of top hat. Single sided tape was then placed to the top joint in all cases.

The installation works were carried out by direct operatives under the supervision of an NVQ2 level qualified gas membrane installer.

Confirmation on materials and verification of installation has been carried out by ADS Geotechnical department and issued along with substantiation.

Works were inspected throughout the install to ensure integrity and condition of membrane had not been compromised in any way.

50mm hard cell insulation board was placed directly onto the membrane to further protect it.

If you should require any further information please feel free to contact me on guy.priestley@ccul.co.uk or 07595 465766

Yours faithfully

Guy Priestley

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Braithwaite Group

HOME BARGAINS STORE, NEWPORT

Ground Gas Risk Assessment



Braithwaite Group

Home Bargains Store, Newport Ground Gas Risk Assessment

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**PROJECT NO. 9774
OUR REF. NO. 9774-GGA-001**

DATE: NOVEMBER 2024

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EXECUTIVE SUMMARY

Site Details	The Site (approximately 1.36 hectares) is located at West Retail Park, Docks Way, Newport with postcode NP20 2NS. The proposed development comprises of the erection of 1 No. retail unit with associated access and serving arrangements and car parking.
Geology	Site investigation proves the site is entirely underlain by a thin veneer of Made Ground over Tidal Flat Deposits (clay and silt with layers of sand, gravel and peat) over the Mercia Mudstone Group.
Coal	The Site is not located in a Coal Mining Reporting Area.
Ground Gas Monitoring	Ground gas monitoring includes monitoring at 4 locations in shallow and deep soils. Several wells are flooded due to high groundwater levels but where wells were functional, they indicate variable concentrations of methane and carbon dioxide up to 54.9% and 5.7% respectively with peak gas flow measured up to 25 l/hr. Peak flows are instantaneous in the boreholes and within 30 seconds steady flows are established which are below detection of the gas analyser.
Ground Gas Protection Measures to new building	BS8485 Gas Screening Values indicates that ground gas protection measures of CS1 are applicable but professional judgement taking into account methane concentrations above 5% is applied so that CS2 is recommended.
Purpose of this report	The development is over natural organic soils and no identified anthropogenic sources of gas are identified. Classification of the site as high risk and requiring CS4 measures is conservative and not in line with current guidance for assessment of risk over alluvial soils. The main objective of this report is to reconsider this classification and provide the appropriate gas measure specification.
Ground Gas Risk Assessment	The gas monitoring has been assessed using peak gas concentrations and flow readings. Flow readings are representative of initial equalisation of pressures in the boreholes with atmospheric pressure. Gas flow rates dissipate quickly and the steady readings, more representative of ground conditions, do not detect a flow. Examination of the potential relationship of tidal variations with fluctuations in groundwater levels has been undertaken. Groundwater monitoring has been targeted at high and low tides (up to 10m variation in tidal levels) and no relationship is apparent. Groundwater levels are within ranges typically influenced by infiltration. Published literature not considered in the previous site reports explains that naturally occurring organic deposits like peat are very unlikely to be credible sources of ground gas on most sites. The Conceptual Model for the site indicates that the organic inclusions and layers are buried at depth beneath low permeability clays as well as being inundated by groundwater so are unlikely to release gas in significant quantities and pathways to the building unlikely. It is documented that on sites with natural conditions found at this site, it is likely that the gas well construction through naturally highly organic deposits has created an artificial situation for the release of small emissions of gas so that readings do not reflect the actual gas risk at the site.
Gas Risk Conclusions	The Conceptual Site Model, published literature and assessment of the gas monitoring dataset presented in this report indicates that gas risk is low for the site. Applying a high risk is overly conservative and the conclusion is that a classification of CS2 is appropriate for the site.
Conclusions	The classification of CS2 indicates that the following gas protection measures are appropriate for the retail/commercial development: - Installation of a cast in situ ground-bearing floor slab (nominal mesh reinforcement). - Installation of a gas resistant membrane across the entire extent of the proposed building, with all joints and penetrations sealed and appropriate installation validation.

1 INTRODUCTION

1.1 TERMS OF REFERENCE

ADS Consult (ADS), a subsidiary of ADS Structural UK Limited, was instructed by Braithwaite Group (the client) to provide a Ground Gas Protection Measures Review for the Site referred to as Home Bargains Store, Newport.

A Site Location Plan and Site Boundary are presented as Figure A.1 and A.2 (Appendix A).

1.2 DEVELOPMENT DESCRIPTION

The development comprises of the erection of 1 No. retail unit with associated access and serving arrangements and car parking.

The development plan is presented as Figure A.3 (Appendix A).

The site has been subject to site investigations, ground gas monitoring and has an agreed Remediation Strategy.

At the time of reporting, construction at the site has started.

1.3 SCOPE AND OBJECTIVES

The Remediation Strategy specifies gas protection measures for the development based on site investigations, gas monitoring and interpretation of published guidance and British Standards. The professional interpretation is that the site should be assigned Gas Characteristic Situation CS4.

This report examines the site data and provides a Conceptual Site Model for Ground Gas and review of published guidance and standards to provide professional judgement on likely gas risk to the end users. The development is over natural organic soils and no identified anthropogenic sources of gas is identified so classification of the site as high risk and that CS4 measures are required may be conservative. The main objective of this report is to reconsider this classification.

The scope of works undertaken is a Ground Gas Risk Assessment to determine appropriate ground gas protection measures to be installed prior to occupation of the building. The scope of this report includes:

- A detailed review of the available ground gas monitoring data and existing ground investigation information.
- An assessment of the current ground model and conceptual model for gas risk at the Site.
- Identification of Ground Gas Protection Measures proportionate to the gas risk at the site.

1.4 REFERENCES

The site has been subject to historical ground investigations and the following report is available to this report:

- HB Newport Ground Investigation Report produced by Fairhurst – Ref. 151157. Doc Ref. 151157/R2.1 (March 2024)
- HB Newport Remediation Strategy produced by Fairhurst – Ref. 151157. Doc Ref. 151157/R3.1 (March 2024)

1.5 LIMITATIONS

This report is addressed to and may be relied up on by:

Braithwaite Group

The 3rd Floor,

16 Cook Street,

Liverpool

L2 9RF

This document has been prepared for the sole use and reliance of the above-named party. This report shall not be relied upon or transferred to any other parties within the express written authorisation of ADS.

ADS neither owes nor accepts any duty to any third party and shall not be liable for any loss, damage or expense of whatsoever nature which is caused by their reliance on the information contained in this report.

The findings and opinions in this report are based upon information derived from a variety of information sources. ADS has endeavoured to assess all information provided and believe these information sources to be reliable.

This report includes summaries of information from external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.

2 ENVIRONMENTAL REVIEW

2.1 SITE HISTORY

The site was noted as undeveloped agricultural land from 1884 with the Upper Great Wharf Reen (artificial drainage channel) and allotment gardens in the western half noted in 1902. By 1937 the allotment gardens are no longer present and a small rectangular structure is noted in the centre of the site. The 1956 map shows no visible features on the site suggesting the former stream below the road and possible settling ponds have become infilled features. From 1970 the site is labelled as a Sports Ground until c1993 when the site was developed with warehouses.

A sewage pumping station was then noted in the northern corner from 2021.

The warehouses have been demolished and the proposed development is in the construction phase at the time of writing.

2.2 GEOLOGY

The published British Geological Survey (BGS) 1:50,000 mapping, Sheet No. 249, Newport Solid and Drift (Dated 1997), historic BGS borehole records and BGS GeoIndex Onshore Bedrock and Superficial Geology Viewer anticipate the following geology on site:

- Made Ground described as Fill (Topsoil with occasional brick fragments)
- Tidal Flat Deposits (superficial), comprising of clay and silt with layers of sand, gravel and peat; sands and gravels below Tidal Flat Deposits likely to be River Terrace Deposits.
- Mercia Mudstone Group (bedrock) comprising mudstones and sub-ordinate siltstones with
- widespread gypsum / anhydrite. Sandstones may also be present.

2.3 COAL MINING

The Site is not located in a Coal Mining Reporting Area.

2.4 RADON

The Site is within a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level), therefore no radon protective measures are necessary.

2.5 LANDFILL

There is no record of landfilling within the site.

The nearest historic landfill is c.88m to the north west of the site and extends to the north west. It is understood to have been former railway land named Land at Newport Sidings.

No other landfills are known within 250m of the site.

3 HISTORICAL SITE INVESTIGATIONS

3.1 SCOPE OF INVESTIGATIONS

Ground investigations were undertaken by LMB Geosolutions, under management and direction of Fairhurst in January 2024, with subsequent gas and groundwater monitoring.

A series of exploratory locations were positioned across the site, targeting areas to confirm ground conditions and ascertain gas and groundwater conditions. The works comprised the following:

- BH01 and BH03 (cable percussive boreholes within the footprint of proposed developments to 15m depth including rotary core follow on to 25m).
- BH02 (cable percussive borehole within footprint of proposed development to 15m depth).
- BH04 (cable percussive borehole outside of the footprint of proposed development to 16m depth).
- TP01 to TP05 (machine excavated trial pits across the site to depths ranging between 1.80m bgl and 3.30m bgl).
- 6 No. rounds of gas and groundwater monitoring within BH01 to BH04.

The site investigation locations are shown on Figure A.4 (Appendix A).

3.2 GROUND CONDITIONS

Ground conditions encountered comprised:

- **Hardstanding (asphalt)** was encountered in all exploratory holes from ground level to depths of between 0.08m bgl and 0.4m bgl.
- **Made Ground** in all exploratory holes to depths of between 1.10m bgl and 2.00m bgl and comprised predominantly of sandy gravel with sub-base, roadstone, asphalt, concrete and brick. TP104 and 105 and BH104 are located in the area of the potentially infilled drainage feature and no changes in Made Ground type is observed indicating it is unlikely that the Reen was infilled with wastes.
- **Tidal Flat Deposits** were encountered directly beneath the Made Ground to depths ranging between 10.50m bgl and 11.20m bgl. This comprised predominantly of a very soft to firm, grey, greyish brown and bluish grey clay, locally sandy.
- **Peat** - In addition to the Tidal Flat Deposits, 2 No. distinct peat layers were noted across the site, comprising of a brown and dark brown slightly clayey peat; Peat Layer 1 encountered between 4.30m bgl and 4.90m bgl and Peat Layer 2 (within BH01-BH04) encountered between 9.00m bgl and 9.5m bgl. Peat Layer 1 was between 0.7m and 0.9m thick and Peat Layer 2 was between 0.5m and 1.0m thick.
- **Possible River Terrace Deposits** - A layer of sands and gravels were noted at the base of the Tidal Flat Deposits, likely to be superficial deposits associated with fluvial processes such as the River Terrace Deposits. The deposits comprised slightly clayey sandy, sub-angular to sub-rounded, medium to coarse sandstone and occasional limestone gravel and occasional layers of clayey gravelly sand with frequent sub-rounded cobbles.
- **Mercia Mudstone** was encountered as weathered to depths of between 16.50m bgl to 21.20m bgl and comprised firm to stiff, reddish brown and blueish grey clay with mudstone inclusions and occasional sub-rounded gravel and rare cobbles.
- Mercia Mudstone was encountered to unproven base depths of 25.50m bgl as a very weak to weak mudstone and clay throughout with moderately strong mudstone encountered beyond 21.0m depth.

3.3 GROUND GAS MONITORING RESULTS

A summary of ground gas monitoring is presented below:

Table 3-1 – Summary of Ground Gas Monitoring Results

Well	Date	Depth to water (m bgl)	Flooded Y/N	Methane %	Carbon Dioxide %	Oxygen %	Gas Flow l/hr		CS Peak/steady	
							Peak	Steady	CH4	CO2
BH101S	26/01/24	2.73	N	1.3	0.6	17.4	0.0	0.0	1/1	1/1
	07/02/24	2.91	N	54.9	5.0	5.5	25	0.0	4/1	3/1
	28/02/24	2.85	N	2.1	0.8	18.4	-22.8	0.0	N/A*	N/A*
	14/03/24	2.29	N	16.80	1.90	15.60	0.0	0.0	1/1	1/1
	05/04/24	2.83	N	4.60	1.10	17.80	0.0	0.0	1/1	1/1
	12/04/24	2.85	N	2.30	0.50	20.10	0.0	0.0	1/1	1/1
BH101D	26/01/24	3.54	Y	1.4	2.7	12.8	0.0	0.0	N/A	N/A
	07/02/24	3.86	Y	1.5	2.6	11.8	-7.0	0.0	N/A	N/A
	28/02/24	3.84	Y	3.1	4.2	8.8	-4.0	0.0	N/A	N/A
	14/03/24	3.75	Y	1.4	1.8	5.9	15.8	0.0	N/A	N/A
	05/04/24	3.72	Y	0.1	3.6	4.4	-12.7	0.0	N/A	N/A
	12/04/24	3.76	Y	0.0	1.0	15.5	0.0	0.0	N/A	N/A
BH102S	26/01/24	1.78	N	0.0	0.3	15.5	0.0	0.0	1/1	1/1
	07/02/24	1.83	N	0.2	0.4	14.5	0.0	0.0	1/1	1/1
	28/02/24	1.98	N	0.0	0.9	11.4	0.0	0.0	1/1	1/1
	14/03/24	1.75	N	0.0	1.40	1.80	0.0	0.0	1/1	1/1
	05/04/24	1.85	N	5.8	0.90	0.00	13.0	0.0	3/1	2/1
	12/04/24	1.87	N	6.2	0.80	0.20	0.0	0.0	1/1	1/1
BH102D	26/01/24	4.41	N	6.7	4.3	10.8	0.0	0.0	1/1	1/1
	07/02/24	4.42	N	15.3	5.7	1.1	17.4	0.0	3	3
	28/02/24	4.65	N	20.4	4.7	2.6	-16.3	0.0	N/A*	N/A*
	14/03/24	4.49	N	24.3	5.5	0.80	-7.6	0.0	N/A*	N/A*
	05/04/24	4.54	N	25.4	5.6	-0.10	0.0	0.0	1/1	1/1
	12/04/24	4.55	N	23.2	5.3	0.00	0.0	0.0	1/1	1/1
BH103S	26/01/24	2.69	N	1.0	2.1	18.0	0.0	0.0	1/1	1/1
	07/02/24	1.98	Y	1.0	2.7	17.3	0.0	0.0	N/A	N/A
	28/02/24	2.04	N	0.9	1.6	16.8	0.0	0.0	1/1	1/1
	14/03/24	1.96	N	1.5	1.1	18.0	0.0	0.0	1/1	1/1
	05/04/24	1.97	N	4.7	2.1	15.1	0.0	0.0	1/1	1/1
	12/04/24	2.06	Y	1.4	1.4	17.3	0.0	0.0	1/1	1/1
BH103D	26/01/24	3.59	Y	0.0	0.7	19.9	7.0	0.0	N/A	N/A
	06/02/24	3.66	Y	0.0	1.3	19.5	36.7	0.0	N/A	N/A
	28/02/24	3.46	Y	0.6	3.2	18.2	-3.0	0.0	N/A	N/A
	14/03/24	3.45	Y	0.3	4.1	16.9	15.1	0.0	N/A	N/A
	05/04/24	3.46	Y	1.7	4.5	15.6	0.0	0.0	N/A	N/A
	12/04/24	3.52	Y	1.4	4.0	15.9	0.0	0.0	N/A	N/A
BH104	26/01/24	1.01	Y	0.0	0.2	20.1	0.0	0.0	N/A	N/A
	07/02/24	1.38	Y	0.0	0.5	19.5	0.0	0.0	N/A	N/A
	28/02/24	1.45	Y	0.0	0.4	19.6	0.0	0.0	N/A	N/A
	14/03/24	1.50	Y	0.0	0.40	19.5	0.0	0.0	N/A	N/A
	05/04/24	1.36	Y	0.0	0.30	19.5	0.0	0.0	N/A	N/A
	12/04/24	1.38	Y	0.0	0.30	20.2	0.0	0.0	N/A	N/A

*Denotes negative flow reading

3.4 GROUND GAS MONITORING RESULTS INTERPRETATION

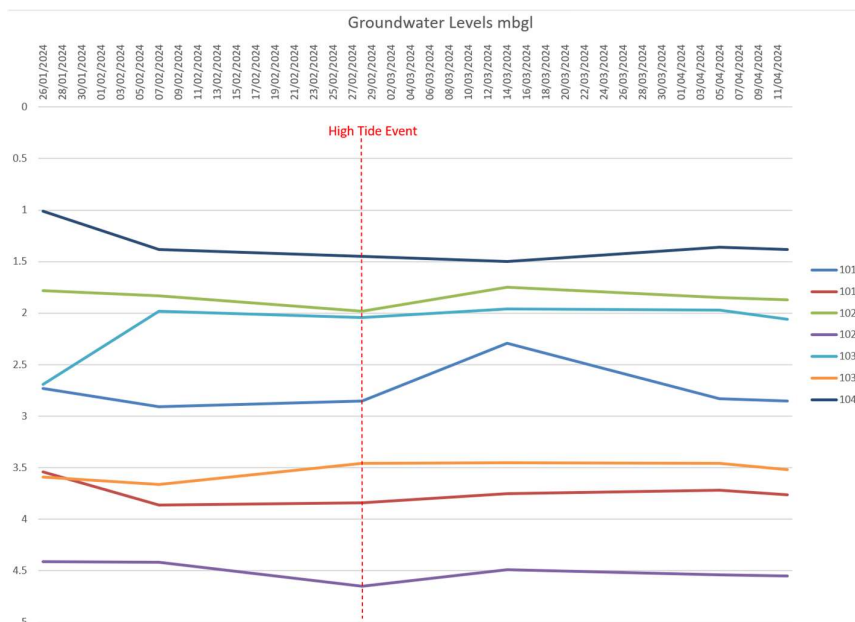
The site investigation calculates 'worst-case' Gas Screening Values (GSV) for methane (CH₄) and Carbon Dioxide (CO₂) as 13.725l/hr and 1.425l/hr, equating to a maximum Characteristic Situation (CS) of CS4 in accordance with BS8485.

BS8485 explains that in using worst case concentrations and flow rates, any peak instantaneous flows and negative flows that have been judged to be unrepresentative of a possible worst case should be discounted.

The site investigation report discounts tidal variation in groundwater levels as a potential driver of flow rates within the unflooded installations. A summary of tide levels at the times of monitoring visits is presented below. Groundwater levels are within normal ranges for influence by infiltration, high tide was on 28 February 2024 and no discernible impact on groundwater levels in the boreholes is observed on the graphical date presented below.

Table 3-2 – Summary of Ground Monitoring in relation to local tide variation

Monitoring Date	Time	High Tide Time	Low Tide Time	Tide Level at monitoring Above chart datum	Level of Tide at Monitoring time	Range of water levels – low tide	Range of water levels – high tide mbgl
26/01/24	14:15	07:30	15:00	1.312	Low	2.29-2.91	2.85
07/02/24	11:50	16:45	10:45	3.116	Low	3.54-3.86	3.84
28/02/24	9:00	9:15	04:00	11.821	High	1.78-1.87	1.98
14/03/24	16:00	09:45	16:45	1.29	Low	4.41-4.55	4.65
05/04/24	9:00	03:30	10:15	3.29	Low	1.96-2.69	2.04
12/04/24	15:35	09:30	16:15	1.203	Low	1.01-1.50	1.45



The Site Investigation Report identifies differential pressures between the atmosphere at ground level and the underlying soils causing the release and flow of ground gases within from the soils as the key driver for the elevated GSVs calculated.

4 CONCEPTUAL SITE MODEL FOR GROUND GAS RISK

4.1 SOURCES

Potential Sources of Ground Gas are considered below:

Table 4-1 – Summary of Ground Conditions and potential for gas generation

Stratum	Description	Permeability	Gas Generation Potential
Made Ground	Dark grey to black slightly sandy slightly gravelly Clay. Gravel sub angular roadstone with rare brick, gravel and glass fragments No organic inclusions observed. No volatile contamination detected.	Low to moderate	Low
Tidal Flats Deposits	Grey to bluish grey CLAY with brown peaty CLAY bands.	Low	Low
Peat	Brown to dark brown slightly clayey PEAT.	Low	Low
Rive Terrace Deposits	Slightly clayey sandy sandstone and occasional limestone GRAVEL	Low	Low
Mercia Mudstone	Mudstone	Low	Low

In addition, as previously reported:

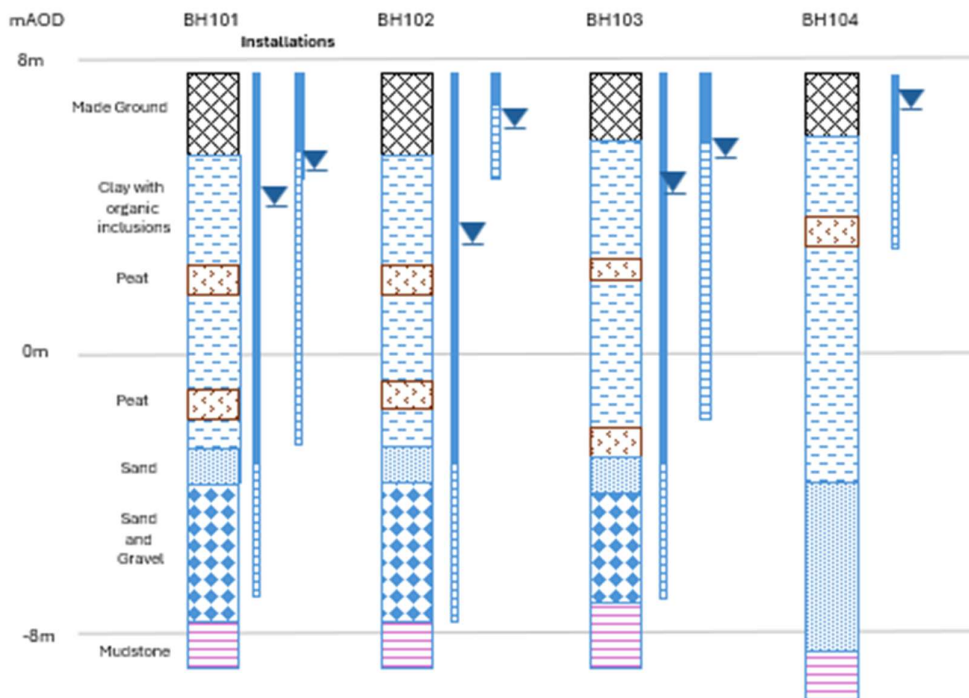
- Groundwater is high in areas of the site, resulting in flooded wells (BH01D, BH103D and BH104).
- No historical landfilling on site. Nearest historic landfilling is c.90m northwest of the site that could constitute a source of gas.
- Low radon potential.

As a result of the above, there is a **low risk** of gas generation at the site.

4.2 PATHWAYS

As presented in Table 4.1 above, the natural soils have a low permeability and are saturated by groundwater presenting a low likelihood for migration of gases from any gas generating inclusions or layers.

Figure 4-2 –Ground Conditions including groundwater levels



As a result of the above, there is a **low risk** of gas migration through low permeability pathways at the site.

4.3 RECEPTOR

The proposed building is the primary receptor for the potential generation and upward migration of gas. The building is an open space, retail unit with good ventilation and there are adjacent ancillary office, welfare and meeting spaces.

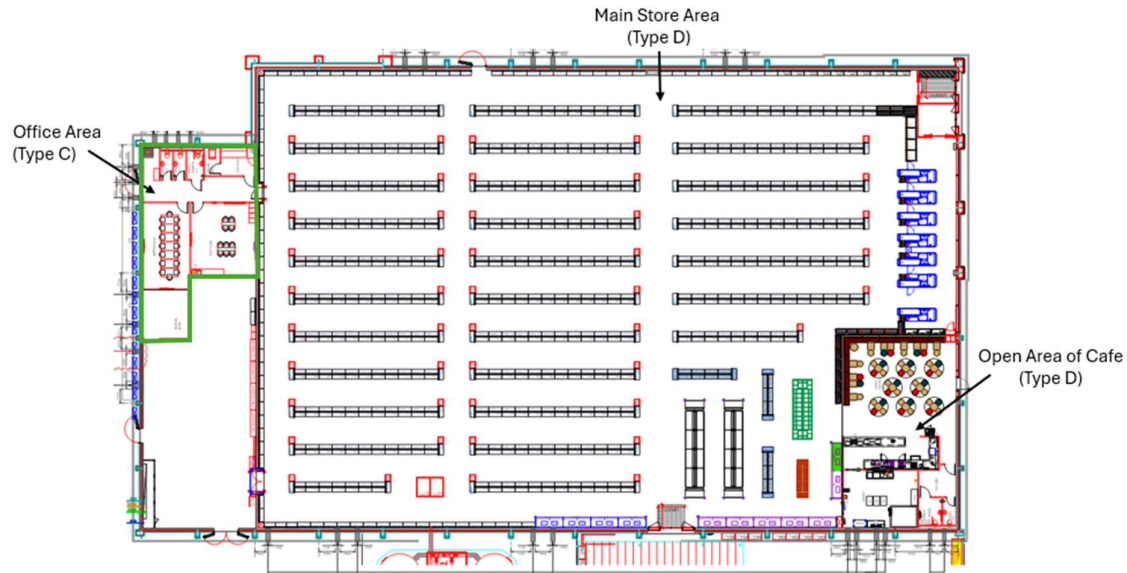
The two uses of the building present different levels of sensitivity to gas ingress and as a result of the above,

- A low sensitivity and allow likelihood of gas ingress resulting in a **low risk** from hazardous gas accumulation in the open, retail space for short visit people use; and
- A high sensitivity but a low likelihood of gas ingress resulting in a **moderate risk** from hazardous gas accumulation in the smaller rooms for regular people use.

In accordance with BS8485:2015, the sensitivity of the end use is reflected by defining different building types, the majority of the proposed development is open space, retail classed as Type D, broadly defined as a large commercial building that is well ventilated, whilst any

smaller office spaces are classed as Type C and broadly defined as small to large size rooms that have active ventilation or good passive ventilation.

Figure 4-3 – Floor Plan of Proposed Building



4.4 CONCLUSION

The above consideration of source, pathway and receptor indicate an overall **low risk** of gas ingress to the proposed development building.

This is based on lines of evidence including:

- No anthropogenic sources of gas are identified on site. The historical Reen may have been infilled but from Trial Holes 104 and 105 as well as BH104 Made Ground is similar in nature across the whole site.
- Made Ground is generally <2m thick with no observations of organic/biodegradable materials.
- The gas source is likely to be organic inclusions in clay or peat layers.
- Significant thicknesses of clay act as a low permeability confining layer over peat.

5 GROUND GAS RISK ASSESSMENT

5.1 GAS RISK ASSESSMENT GUIDANCE

Whilst BS8485 has not been updated since 2019, NHBC published their '*Hazardous Ground Gas – an essential guide for home builders*' in 2023 which sets out considerations for gas risk assessment that are relevant to this site, highlighted as below:

- The reliability of measured gas flow rates and concentrations takes borehole construction into account and decisions are made about how to deal with any temporal or spatial shortages in the data.
- Natural alluvium or mud flat deposits, including geological peat, are very unlikely to be credible sources of ground gas on most sites. The organic material is locked in a low permeability matrix. The gas generation rates are incredibly low, except when oxygen is artificially introduced via borehole or ground disturbance. Card *et al* advise that the gas that is measured in Alluvial soils is predominantly from historic generation and is effectively immobile in the ground because of the saturation and low permeability of alluvial soils. Methane is also adsorbed onto the organic material and is only mobilised when a well is drilled into it.
- A GSV is not a simple multiplication calculation but is a value determined using professional judgement and should be made with reference to all other lines of evidence and the conceptual site model. Judgements are made regarding the site characteristic GSV in the assignment of the Characteristic Situation and for design purposes, taking all relevant information and the conceptual site model into account.

BS 8485 (Clause 6.3.7.4) describes the completion of a “worst case” assessment, but in any event, the assessor needs to determine if such an approach is “reasonable”. For example, a reasonable approach may not comprise the multiplication of the site’s maximum gas concentration by the site’s maximum flow rate. BS8485 (Clause 7.7.3.4) advises that such a worst case assessment is appropriate where there is limited data (i.e. less than required by BS8576) and it should be calculated using reasonable worst case measurements in the same stratum. However, it also advises that to adopt the worst case as a site characteristic GSV, the assessor should be confident that it is prudent and reasonable to do so and does not result in unnecessarily conservative protection of the development.

Research Bulletin 17 (CL:AIRE 2012) also presents a discussion of how the construction of the monitoring well is an artificial construction in the ground that can, in some specific instances, cause high flow rates from or in the well headspace that are not necessarily representative of sustained surface gas emissions. One factor that can have a significant influence on monitoring results is differential pressure where a well with a response zone spanning different strata may be different to pressure recorded in discrete locations. This could create an artificial flow regime. It is noted as a particular problem where:

- More permeable strata are confined by impermeable material such as clay over sand layers or clay over peat which is the case at this site.

- The presence of the monitoring well creates an artificial mechanism by which gas can enter the headspace of the well (e.g. where the response zone intersects a layer of peat that is confined with more impermeable layers above and below it).

Based on published information, there are lines of evidence to demonstrate that:

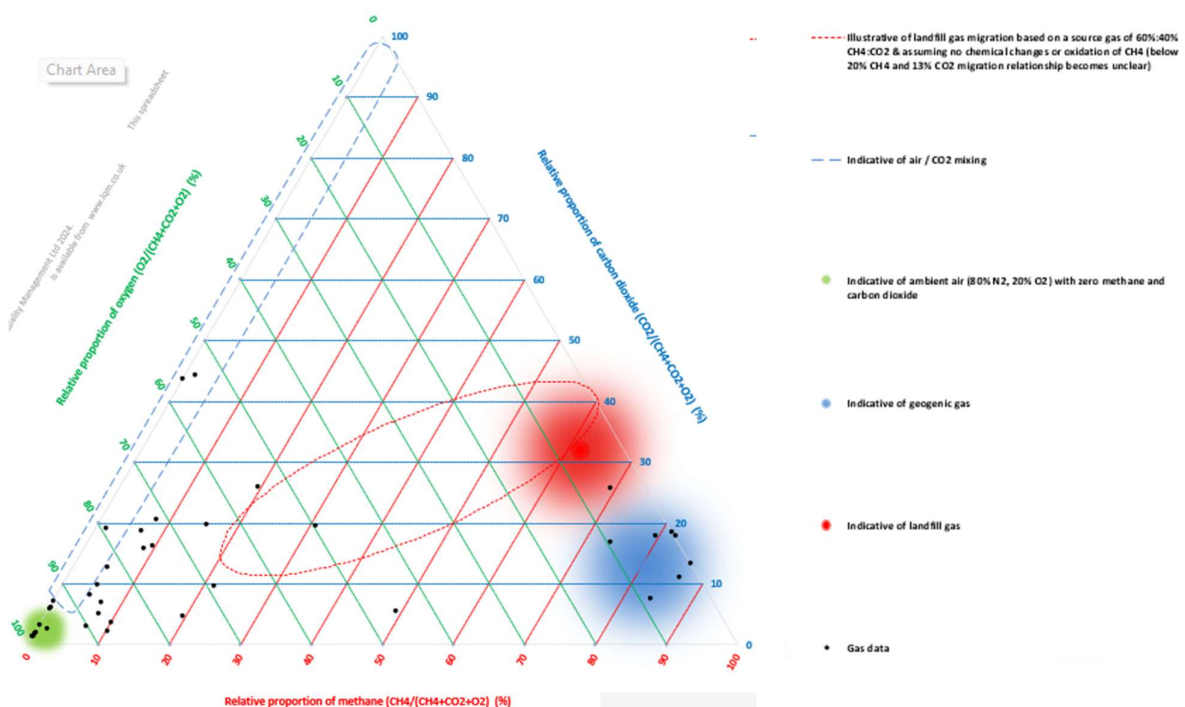
- Natural deposits of alluvium and peat, whilst high in organic content, do not represent a significant gas generation source.
- Constructing a monitoring well across natural organic deposits can create artificial conditions that lead to high gas concentrations and flows being measured.

The site geology, well construction and gas data are similar to the published examples.

5.2 GAS SOURCE IDENTIFICATION

To demonstrate that the gases encountered at the site are attributable to natural soil organics, a Ternary Plot has been undertaken and presented below:

Figure 5-1 – Ternary Gas Composition Plot for ground gas results



The above plot indicates that the gases detected are typical of:

- shallow air/carbon dioxide mixing zone – this is the majority of the readings, but these readings are also skewed by flooding of wells:
- the remaining readings are not indicative of landfill gas but likely to be geogenic (vegetation derived) – at this site this is organic inclusions, peat and elevated total organic content in groundwater.

5.3 EXAMPLE OF VARIABLE MONITORING RESULTS IN ALLUVIUM STRATA

Whilst no development site is the same i.e. ground conditions and proposed developments are potentially highly variable, the recent (2020) development of Whiteheads School approximately 200m north of the site shows similar ground conditions.

The location of the site in relation to the development site is shown below with borehole locations. The boreholes proved the same Tidal Flats Deposits with peat bands, gas monitoring did not detect gas concentrations or flows above CS1.

Figure 5-2 – Nearby Site to the development with borehole locations



This report has highlighted this nearby site only to further demonstrate how the construction of the gas monitoring installations can lead to variable monitoring results. The above site installed shallow installations i.e. within 5m of ground level. The development site installed deeper boreholes with longer response zones.

5.4 GAS RISK

5.4.1 GAS FLOW MEASUREMENTS

Gas concentrations and flow rates (see Table 3.1) are variable.

Gas flow measurements are presented across a 4-minute measurement period. The initial spike recorded when opening the borehole is a peak flow and flow readings then settle to a steady measurement.

The Site Investigation Report rules out tidal variations causing fluctuations in groundwater levels which in turn cause compression or expansion of the air void in the monitoring pipe and

result in positive or negative peak flows. The report instead explains this as being a result of differential pressure between the borehole and the atmosphere outside.

Published guidance (Section 5.1) summarises this effect. Flows at site are observed to quickly dissipate and reduce to zero, becoming stable at zero flow in all wells on all visits. This indicates that the gas volume generated is low and there is no significant continual generation rate is present. The same phenomenon is observed in wells that are completely flooded where these have positive or negative peak flow that settle to a steady no-flow. From this it is concluded that the well construction on site is such that flow monitoring observes a short peak flow as a result of pressure equalisation between confined air in the pipe and the atmosphere and not pressure from gas generation in the ground.

5.4.2 GAS CONCENTRATION MEASUREMENTS

The gas monitoring also observes high concentrations of methane and carbon dioxide. There is a concern that even if generation rates are slow, there are conditions where high cumulative gas concentrations generated in the ground can migrate upwards in a short-term event, potentially causing unsafe concentrations within the building.

The Conceptual Site Model demonstrates that the embedded gases in organic deposits like peat do not have an effective pathway to surface being covered by significant thicknesses of low permeability clay. Published guidance explains that this is common in alluvial soils and is a result of the well being constructed through organic deposits.

5.4.3 CALCULATION OF GAS RISK

Taking into account the nature of gas source and the understanding of the ground gas measurements on site, it is appropriate to apply professional judgement to the monitoring dataset. The dataset presented in Table 3.1 shows the following:

- Peak gas concentrations are variable in the same hole as well as across the holes at site. The highest peak concentrations are in BH101S but four out of the six visits record methane <5%.
- All monitoring events record zero steady flow conditions indicating low gas generation rates.
- The majority of Individual GSV's are CS1.
- The Conceptual Site Model concludes a low risk of gas to the building due to low permeability clays and groundwater are significant barriers to upward migration of ground gas.
- The well construction has introduced an artificial migration pathway for embedded gas in organic deposits and is not representative of the undisturbed ground profile.

As a result of the above, a CS4 classification is considered unrepresentative of the actual gas risk at the site. Additional monitoring may indicate CS1 is appropriate. In the absence of this additional monitoring and to recognise the commercial timescales for development, a CS2 classification is considered appropriate.

6 SPECIFICATION OF GAS PROTECTION MEASURES

The Ground Investigation Report and Remediation Strategy classify the site as CS4 with respect to requirement for protection from ground gas.

The above risk assessment concludes that this represents a conservative assessment not taking into account more recent guidance and the requirement for professional judgement.

The gas concentrations and flows measured are spurious and representative of conditions created by the well construction rather than the actual release and migration of gas from confined and low permeability organic layers.

The appropriate classification of gas risk is CS2.

The Remediation Strategy specifies the combined use of the following gas protection measures to provide a total score of 4.5 points ensuring both Type D and Type C areas of the proposed building are sufficiently protected.

- Cast in-situ reinforced ground bearing floor slab with minimal penetrations, providing 1.5 points as a structural barrier against ground gas ingress.
- Passive sub-floor dispersal layer design in accordance with Annex B of BS8485:2015, attaining 'good performance' thereby providing 1.5 points as ventilation.
- Installation of a gas resistant membrane across the entire extent of the proposed building, with all joints and penetrations sealed and appropriate installation validation, providing 2 points.

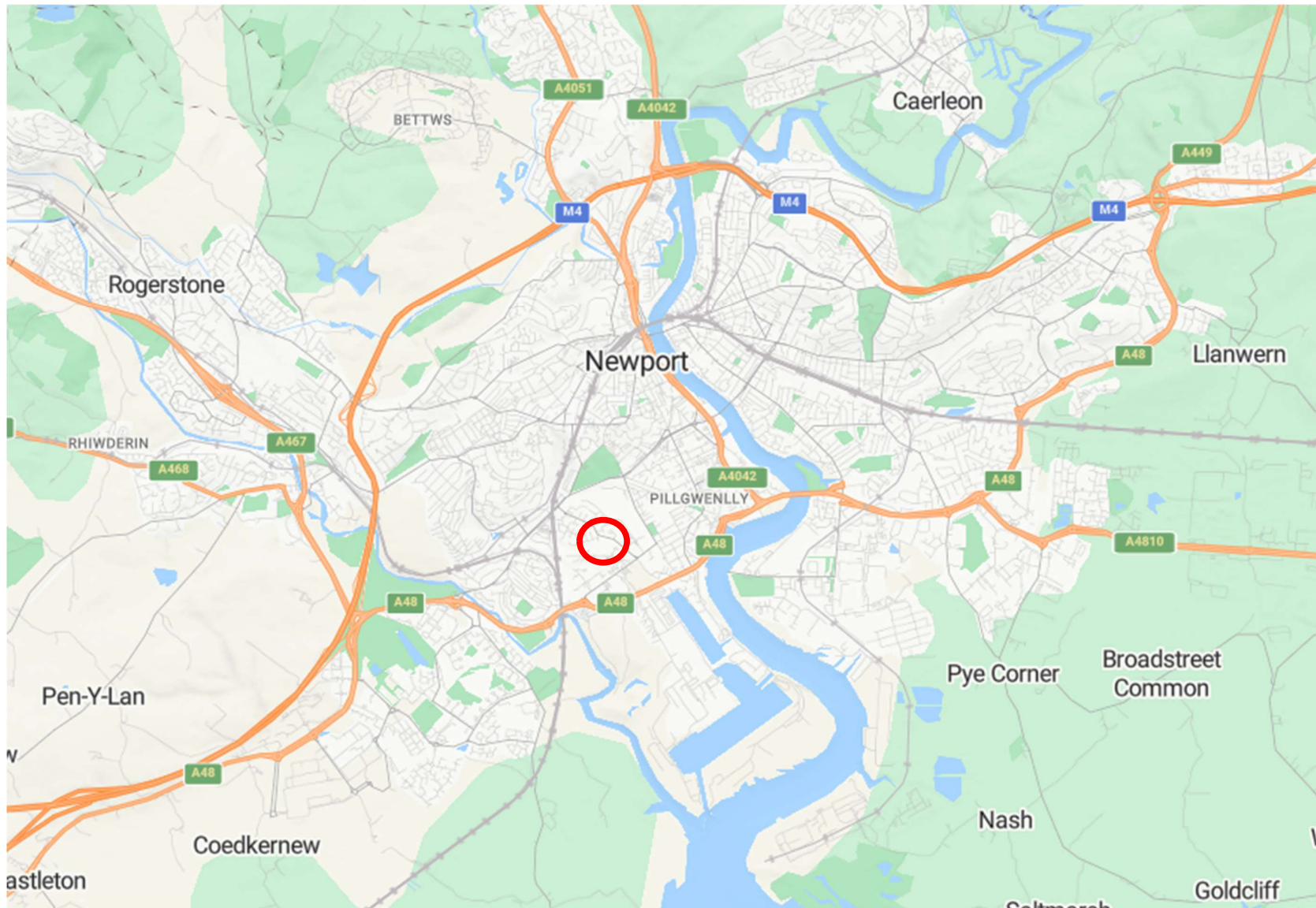
However, CS2 measures are appropriate requiring an overall score of 2.5 and 1.5 for Type C and D buildings, respectively. The required scores for gas protection elements and measures to achieve the scores are presented in Table 6.1 below.

Table 6-1 –Ground Gas Protection Measures Specification for CS2

Gas Protection Measure	Points	Office areas (Type C Building)	Open Shop Floor Area (Type D Building)
Cast in-situ ground-bearing floor slab (nominal mesh reinforcement) with minimal penetrations.	0.5	✓	✓
Installation of a gas resistant membrane across the entire extent of the proposed building, with all joints and penetrations sealed and appropriate installation validation.	2	✓	✓
Required Points		2.5	1.5
Points achieved by measures		2.5	2.5

Appendix A

FIGURES



Key



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St Helens
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Figure A.1
Site Location Plan

Project:
Home Bargains, Newport

Project No.:
9774

Client:
Braithwaite Group