Development of Brownfield Sites: What You Need To Know
DEVELOPMENT OF BROWNFIELD SITES: WHAT YOU NEED TO KNOW

Drivers for development: the need for brownfield sites
Since 2008 the number of new households in the UK has continued to exceed the number of new homes built, giving rise to the current shortage in housing supply, and creating the urgent need for a period of sustained development within new house building. The Government has set two clear targets in relation to house building supply: to deliver 1 million new homes by 2020, and to provide 240,000 homes in 2016.

In the need to identify suitable land, the development of housing on brownfield sites will be fundamental in achieving the objectives set by government. A. Proctor Group has over twenty years’ experience in providing solutions for the safe development of brownfield land, and has an extensive range of products and solutions that will cater for most scenarios from typical ground gases such as methane and carbon dioxide.

In the drive to reverse the shortage of housing supply, the Government has ambitions that it expects to see local development orders being used to get planning permissions on at least 90% on suitable brownfield sites by 2020. In order to do this, it has implemented a package of support that local authorities can use, with a total of £400 million of government funding being invested to create housing zones on brownfield land.

A local development order is designed to streamline the planning process by removing the need for developers to make a specific planning application. They are designed to create certainty and save time and money for those parties who are involved in developing certain sites. So potential developers are almost guaranteed that the planning process won’t hold up their site.

Geographically the Government is investing £200 million, creating 10 housing zones outside of London and £400 million jointly with the Mayor of London to create 20 new housing zones in London. So this initiative will cover the whole of England. The devolved regions will have their own plans.

These housing zones are expected to be between 750 and 2000 homes and the £200 million is to be used for remediation and infrastructure as a carrot to get these schemes off the ground.

Aubrey Machin, Ground Protection National Technical Sales for A. Proctor Group explains, “The Government is referring to the use of brownfield sites that are suitable for development, not sites which are too heavily contaminated and in need of expensive remediation. The sites that are to be identified are those which developers would consider viable, with either no special environmental protection measures, or sites which would be considered viable within the guidance outlined in BS8485: 2015 (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings) or NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination. Developers should also consult the guidance documents CIRIA 716 and 748 detailed below.”

Guidance, legislation and compliance
A. Proctor Group is working with developers and contractors to guide them on all aspects of designing gas protection systems. From recommending the ideal level of protection for a particular site, through to selection of suitable materials, and advice on detailing, highly trained specialists provide technical assistance to give developers the confidence to build on brownfield sites. Further guidance of good practice on the testing and verification of protection systems is given within the document CIRIA 735, which recommends specialist installers are qualified to NVQ Level 2 in Gas Membrane installation.

As part of providing this complete service, relationships with strategic partners enable total solutions advice at all stages of the project, from identification and risk assessment through to design, supply and installation. Our network of partners include:
- Consultants specialising in all aspects of gas protection system design
- Specialist installation sub-contractors
- Consultants offering independent verification of gas protection installations

In the UK guidance is primarily given through BS8485: 2015, Code of practice for the design of protective
measures for methane and carbon dioxide ground gases for new buildings, with supporting guidance specific to housing developments provided by the document, Guidance for the Safe Development of Housing on Land Affected by Contamination, published jointly by NHBC, The Environment Agency and The Chartered Institute of Environmental Health. Additionally, the key guidance documents CIRIA 748, 735 and 716 should be consulted.

BS8485: 2015, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
BS8485 recognises that a number of factors can affect the sensitivity of an individual development to the effects of ground gas, and that different design solutions will be required to suit specific site conditions. It is recommended that specialist advice be obtained during the risk assessment phase. It provides a key reference to CLR11 Model procedures for the management of land contamination, which offers guidance for designers on ground gas site investigations.

BS8485 provides recommendations on ground gas characterisation and the choice of design solutions for protective measures relating to new buildings and developments.

The latest edition of BS845 was revised in 2015. Some of the key changes are outlined below:
- Clearer guidance on the assignment of characteristic gas situations (CS)
- Revised and new scoring system on protection measures
- Updated building classifications / definitions
- Reporting requirements at design, construction and verification stage
- More detailed guidance on interpretation of gas monitoring data
- Cross referenced to BS8576 2013 Guidance on investigations for ground gas - Permanent gases and Volatile Organic Compounds (VOCs) and to CIRIA C735 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases

The following key guidance documents issued by CIRA are also important for all those involved in the development of brownfield sites:

CIRIA C748, Guidance on the use of plastic membranes as VOC vapour barriers.
Where building on brownfield land, typical contaminates may include volatile organic compounds (VOC). This publication provides guidance on the use of plastic membranes to reduce vapour migration in buildings. It looks at vapour transport mechanisms that occur in membranes, factors that influence them and outlines the test methods for vapour permeation and use of test results in risk assessment. The guide also considers durability and methods of assessing performance.

CIRIA C735, Good practice on the testing and verification of protection systems for buildings against hazardous ground gases.
Provides good practice for the designer, installer, verifier and regulator on the verification and integrity testing of gas protection systems.

CIRIA C716, Remediating and migrating risks from volatile organic compound (VOC) vapours from land affected by contamination.
Offers clear and flexible guidance specific to the management of VOC vapours, primarily relating to inhalation by people. A range of source treatment/management, pathway management and receptor management solutions are outlined, including advantages and disadvantages.

Best practice procedures
The drive by the Government towards the greater use of brownfield land increases the need for sound best practice procedures, and demands robust measures are in place to ensure that specialist advice is obtained at each of the key stages of site investigation, risk assessment, solutions choice, detailed design, implementation and verification.

BS8485 sets out the following key stages for the design of protective measures for ground gases for new buildings:
Site Investigation
Prior to the design of any protective measures, the first phase of site investigation to be undertaken is the preliminary investigation. This may take the form of desk research and initial site reconnaissance. Information about the history of the site, along with its current use and the surrounding area, will help to identify the potential ground gas sources, along with migration pathways and receptors. The geology and hydrogeology, and the presence of contamination and its effect on gas sources should be considered here too. The desk research will also seek to establish the preliminary conceptual site model, which will determine the approach to assessing gas risk for the site, and the requirements for field investigation, laboratory testing and gas monitoring.

Where desk research identifies a site requirement for field investigations for ground gases, then the design and implementation of the field investigations should be in accordance with BS8576: 2013.

The information gathered during the site investigation will be used to refine the preliminary conceptual site model and generate the conceptual site model for design purposes. The conceptual site model will identify the ground gas sources, the sensitive receptors (users of the building) and the pathways between them.

Risk Assessment
In advance of the design of protective measures for buildings, a risk assessment is to be carried out to establish:

- Whether there is a potentially hazardous situation
- What the magnitudes of associated risks are

Detailed guidance on how to conduct risk assessment can be found in CIRIA C665.

A number of methodologies for ground gas characterisation are considered within BS8485. Review of data from monitoring may highlight variations in gas monitoring results. Where clear reasons for the variations can be identified, this could suggest that a large site be separated into a number of smaller zones.

The characteristic gas situation (CS) will be determined from the assessment process. BS8485 identifies six levels of characteristic gas situation as outlined in the table below:

<table>
<thead>
<tr>
<th>CS by site characteristic</th>
<th>Site Characteristic GSV(^a) L/h</th>
<th>Additional Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS1 Very Low</td>
<td>&lt;0.07</td>
<td>Typically &lt;1% methane concentration and &lt;5% carbon dioxide concentration (otherwise consider an increase to CS2)</td>
</tr>
<tr>
<td>CS2 Low</td>
<td>0.07 to &lt;0.7</td>
<td>Typical measured flow rate &lt;70 L/h (otherwise consider an increase to CS3)</td>
</tr>
<tr>
<td>CS3 Moderate</td>
<td>0.7 to &lt;3.5</td>
<td>-</td>
</tr>
<tr>
<td>CS4 Moderate to High</td>
<td>3.5 to &lt;15</td>
<td>-</td>
</tr>
<tr>
<td>CS5 High</td>
<td>15 to &lt;70</td>
<td>-</td>
</tr>
<tr>
<td>CS6 Very High</td>
<td>&gt;70</td>
<td>-</td>
</tr>
</tbody>
</table>

\(^a\) The figures used in this column are empirical.

NOTE The CS is equivalent to the characteristic GSV in CIRIA C665.

Solutions Choice & Detailed Design
The level of gas protection required for the site will be determined and selected based on the characteristic gas situation and the specific building type planned for development. BS8485 provides a method for categorising buildings into one of four building types: Type A, Type B, Type C or Type D. In assessing a building, both the construction and use of the building, together with the control of future structural changes to the building and its maintenance, should be considered.
From the design CS and the type of building (A, B, C or D) the minimum level of gas protection (score) in the range 0 to 7.5 should be determined in accordance with the table below.

Gas protection score by CS and type of building

<table>
<thead>
<tr>
<th>CS</th>
<th>Type A building</th>
<th>Type B building</th>
<th>Type C building</th>
<th>Type D building</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>3.5</td>
<td>3.5</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>4.5</td>
<td>4</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>3</td>
<td>6.5(^{A)}</td>
<td>5.5(^{A)}</td>
<td>4.5</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>(\geq 6.5) (^{A)}</td>
<td>(\geq 5.5) (^{A)}</td>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td>5</td>
<td>(\geq 7.5) (^{A)}</td>
<td>(\geq 6.5) (^{A)}</td>
<td>7.5</td>
<td>6.5</td>
</tr>
</tbody>
</table>

\(^{A)}\) Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. institutional and/or fully serviced contractual situations.

\(^{B)}\) The gas hazard is too high for this empirical method to be used to define the gas protection measures.

BS8485 states that ‘when the minimum gas protection score has been determined for the building as a whole, or for each part of the building, then a combination of two or more of the following three types of protection measures should be used to achieve that score:

- the structural barrier of the floor slab, or of the basement slab and walls if a basement is present
- ventilation measures; and
- gas resistant membrane’.

When the types of protection measures have been agreed, the detailed design can be undertaken, with the design measures being recorded in a design report.

Implementation, verification and reporting

BS8485 identifies the steps that should be taken in the installation of gas protection measures, how to undertake on-site verification of protection measures in accordance with CIRIA C735, and the requirements for preparation of implementation and verification reports. Full details of the information to be included in the design, installation, and verification reports, is outlined within the standard.

Further guidance

Whatever your project a member of our technical team is on hand to guide you on all aspects of gas protection systems. For clients looking to develop on brownfield sites we are able to advise you on best practice to ensure the right level of protection to suit site conditions, selection of the most appropriate products and solutions and achieve full compliance with current legislation and guidance standards.

A. Proctor Group can facilitate contact between our clients and professional companies in the field of gas protection systems, who can offer quotations for:

- Full design of systems in line with site-specific investigation, and remediation strategy covered by £1m professional indemnity
- Installation of gas protection measures by our connections with CSkills NVQ Level 2 qualified installation contractors
- Verification by independent consultants providing validation plans including relevant levels of integrity testing specific to site risks
The latest solutions in ground gas protection

A. Proctor Group has extended its range of ground gas protection products to include Protech VOC Flex, a new and innovative solution in membrane technology, specifically to make the development of these sites safer and easier.

However, with the emphasis that is being placed on brownfield development, more is required from the systems that have traditionally been used for ground gas protection. We therefore decided to develop a new membrane that is designed specifically to meet the needs of these sites. Principally our new membrane was designed as a Hydrocarbon and VOC membrane, as in our experience, these are typical of the type of contaminates present on many brownfield developments. It is more than just another membrane offering. We have a programme of continual testing, which we are carrying out in order to provide not simply a hydrocarbon membrane, but a chemical barrier, which should be suitable against a whole range of contaminates.

The reasons for developing Protech VOC Flex, and the benefits it provides are extensive. Previously the membranes, which were recommended to provide protection for buildings, were derived from landfill and industrial solutions, typically HDPEs of various thickness. The main problem with these membranes is that they are incredibly difficult to work with and detail, particularly on housing schemes, where the house plots are small. So the main design objective was to produce a membrane, which is highly resistant to Hydrocarbon and chemical attack, plus strong and robust enough to survive the build process (highlighted in BS8485 2015), more importantly flexible enough to detail and install quickly and easily. Our initial projections are that it should be four times faster to install against traditional HDPEs.

**CPD - Building on Contaminated Land**

Protecting Structures from the Ingress of Gas

As you will know there have been some significant legislative changes in regards to how a structure is protected against gas over the past 12 months. As a company the A Proctor Group has been supplying gas membranes and venting systems since 1995. Due to the new guidelines we have re-written our CPD offering which covers the following:

- When and why do we protect against harmful gases
- Interpreting Site Investigation and Gas Monitoring data
- Integrity testing and Site Validation
- Installation
- Legislative changes:
  - CIRIA 735:2014
  - CIRIA 748:2014
  - BS8485:2015
  - NHBC Technical Extra April 2016
- Design Services from A Proctor Group

To book a CPD seminar please contact us using details below.

**Ground Gas Protection Team**

Whatever type of project you’re considering, contact a member of our Ground Gas Protection team to discuss your requirements, we’re always happy to help you find a solution.

Justine Gray

Aubrey Machin

[www.proctorgroup.com/ground-gas-protection](http://www.proctorgroup.com/ground-gas-protection)