



# GROUND GAS PROTECTION ASSESSMENTS

## Overview

Walsall Council's Environmental Protection Team has produced this information note to assist developers, architects and builders in satisfying conditions placed on their planning permission relating to the installation of ground gas protection measures. It is not intended to be definitive, and aims to give an introduction to the subject.

Further useful guidance can be obtained in the following publication: "Protective measures for housing on gas-contaminated land", BRE Report 414, ISBN 1 86081460 3 (Appendix 1).

### **IMPORTANT:**

**Walsall Council is NOT able to design a gas protection system. You will need to seek the advice of a specialist consultant/engineer, supplier of installer**

'Ground gas(es)' in context to this note refers in the main (but not exclusively) to carbon dioxide, carbon monoxide, methane, hydrogen sulphide, radon and other volatile organic compounds. The nature of ground gas(es) likely to be affecting a particular site should be determined with the council in order that appropriate remedial measures are installed.

When planning and other development takes place, construction may occur on land which has a potential, or is known, to emit ground gas. When a planning application is received, Development Management will normally consult with Environmental Protection in order that they can review any information held about the site; advise whether previous site investigations or records of land use are held; and offer any comment on known or potential ground gas concerns.

The Coal Authority is also a consultee to planning applications and will have its own requirements for ground gas protection associated with previous mining activity.

In order to protect future development, Environmental Protection adopts the stance that all land with the potential to release gas(es) should be treated the same. Therefore, unless adequate information is available to remove any concerns surrounding a particular site, a worst-case scenario will likely be considered as a default.



### Principles of Ground Gas Protection

Gas protection measures are used to interrupt possible gas migration pathways into buildings and structures. In this note only 'passive' measures are considered. These rely on creating a permeability difference between, for example, a building and areas where gas can vent to the atmosphere (such as via a sub-floor void), by using low permeability barriers within foundations and building structures sometimes in conjunction with means to vent sub-floor areas.

The primary aim is to prevent the build up of hazardous, or explosive, or asphyxiant concentrations of gas within buildings in to protect the safety of occupants and the structure(s), and persons who may have reason or need to enter buildings and enclosed spaces.

### Small-scale developments/extensions

For small-scale developments the cost of investigations into ground gas levels may outweigh the cost of the development, therefore Environmental Protection may recommend a condition requiring the installation of ground gas protection measures at the onset. It should be noted however, that this option is typically provided with the intent of reducing financial or time constraints likely to be experienced by the applicant.

An applicant may choose to install gas protection measures rather than undertake investigations and gas monitoring. Applicants and developers must recognise that in taking this approach, the required gas protection measures can be relatively onerous and could even be considered extreme (or potentially unnecessary) in some cases, when compared to requirements based on findings of suitable investigations and ground gas monitoring.

As a general principle, ground gas protection measures for extensions to buildings and properties must at least match those of the original development to ensure continued protection.

Information on original designs and specifications may be available from the councils' Development Management, NHBC or the original Building Control inspection service.

With the introduction of new legislation, guidance and a greater understanding of ground gas risks, councils are usually requesting gas protection measures for all developments potentially at risk. Many properties and buildings may have been built without protective measures at a time when landfill gas risks may not have been fully understood or known about, or perceived as a potential risk. Extensions or alterations to these properties will nonetheless be required to incorporate ground gas protection measures that meet current standards.



### Ground Gas Protection Measures for Large Scale Developments

For larger scale developments a site investigation including comprehensive ground gas monitoring and characterisation of the risk can be required following any demolition or site clearance work and prior to built development commencing.

Where the presence of ground gas(es) is identified, a 'Remediation Statement' must be prepared setting out requirements for the design and specification of gas protection measures necessary to mitigate risk.

Gas protection measures should only ever be used after the gassing regime has been characterised and it has been confirmed that the gas protection measures are appropriate.

There is a wealth of current and emerging guidance relating to ground gas protection measures at the time of writing. Information is available from manufacturer's standard details, Building Research Establishment Paper No 414 and the NHBC / RSK document

'Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present, Appendix E', may also be of use (see Appendix 1). This list is not exhaustive.

British Standard BS8485:2015+A1:2019 (see Appendix 1) and Construction Industry Research and Information Association document C665 (see Appendix 1) set out a matrix of assessment and protection requirements.

For residential development, in the majority of cases this will comprise a vented sub-floor and a gas-impermeable membrane; notwithstanding, higher levels of protection may be required. Suitable protection measures can be achieved for all foundation types and designs to accommodate varying ground conditions.

Industrial and commercial development will require more detailed consideration of protection measures to take account of the type of building construction, business activities and processes.



### Installation of Gas Protection Membranes

The need for high quality workmanship during the installation of a gas-resistant membrane must not be under-estimated. The ongoing protection of the occupants of buildings and structures, and those having cause to use or enter them, is dependent on its continued performance.

Even a very small (nail-sized) puncture or badly sealed joint in a ground gas protection membrane can render it useless, therefore correct installation is vital. It is a pre-requisite to always make sure that a site is ready for laying a gas membrane (swept clean etc.) and ensuring it is fitted strictly in line with the manufacturer's instructions to ensure it functions properly.

The most effective method of achieving high quality workmanship is to employ specially trained quality assured teams who follow best practice guidance. All work should ideally be subject to third-party independent scrutiny, for example inspections by a building inspector or suitably experienced and qualified persons.

If there are doubts upon the quality of any installation, post-installation integrity testing of the membrane, jointing and other details may be undertaken. Any leaks found in the membrane itself or at joints and service penetrations should be sealed before construction continues.

There are several non-destructive test methods, for example vacuum box, air pressure, ultrasonic or air lance; all have shortcomings when applied post-installation of gas membranes. The most effective post-installation test method is to pressurise the underside of the membrane with an appropriate tracer gas and then sweep the top surface with a suitable gas-detection device. The advantage of this method is that the whole membrane, including joints, are tested. It has been demonstrated that this test method can detect even very small gas migration routes in the membrane (BRE414) (Appendix 1).

The NHBC / RSK document (Appendix 1) contains a checklist for installation, and BRE414 (see Appendix) has a series of 'watch points' for each testing scenario. Walsall Council has a checklist for the installation and inspection of ground gas protection measures which is appended to this document.



### Gas Alarms

These are devices set to provide audible and visual alarms if hazardous concentrations of ground gas are detected within a building or other enclosed space. Typically, they are used in publicly accessible buildings where triggering of the alarm results in building evacuation or other managed responses.

Gas alarms are generally only used as an additional protection for high risk sites where a building for example has been constructed without suitable protection measures. They can require on-going service and maintenance, and installation and operational costs are usually high.

Systems such as gas alarms that require maintenance are unlikely to be approved for use in private residential housing developments or in structures or buildings associated with the same.

### Planning Conditions

Conditions may be included in a Planning Approval requiring, for example, to:

- Undertake gas monitoring and assessment of risk.
- Give details of intended measures to mitigate the risks of potential ground gas ingress.
- Provide evidence of successful installation of mitigation measures.

Information needs to be provided to the Local Planning Authority to show how these requirements are fulfilled. A guide to the information required is given below. Gas monitoring and risk assessment Confirmation that the principles set out in BS8576, BS8485 and CIRIA 665 have been followed.

Typical information to be reported:

- Details of the construction and position of monitoring points
- Frequency of sampling, details of weather conditions, details of gases identified, details of sampling equipment.
- Results of the sampling including concentrations of gas, monitoring point flow rates, groundwater level.
- The calculated 'Gas Screening Value' and characterisation classification of the site based on the gas screening value



### Intended measures and risk mitigation

Set out detailed specifications and drawings describing the measures to be used or installed to mitigate identified ground gas risks and protect occupiers or the building.

These will need to be produced by a suitably qualified competent person who is able to confirm that the proposals meet relevant regulatory requirements, published guidance and current industry standards.

Typical details required:

- Drawings showing the position of gas impermeable membranes within the structure.
- Details of any gas ventilation arrangements.
- Arrangements for preventing gas ingress through any service entries or other structural penetrations through the membrane
- Technical specifications for materials used eg. Membrane, jointing materials etc.

Note: The details, drawings and specifications must be sufficient to clarify site specific requirements for construction. This is to ensure that builders and installers can follow the drawings on site and aid inspection work. Provision of a product supplier's 'Standard

Details' will not be sufficient. Assistance in obtaining correct drawings should be available from architects, designers, or agents who are involved in preparing a development scheme.

### Evidence of successful installation

To satisfy this requirement it is necessary to provide a 'Validation Report' compiled by a suitably qualified, experienced and competent party. This may comprise a Building Inspector, Specialist Installation Contractor, or Consultant/Engineer specialising in ground gas or related issues. The report should confirm that the detailed mitigation measures for the site have been installed to a good standard in accordance with the design specified to mitigate risk, using appropriate methods and materials, and if appropriate, tested to demonstrate integrity.

Typical information to be reported:

- Qualifications, experience and examples to demonstrate competency of any person(s) compiling the report
- Date(s) and time(s) of site inspection work
- Details of materials used
- Records of any defects noted, and details of repairs made
- Justification for any deviation from the specified design
- Date(s), time(s) and result(s) of any testing
- Photographic records of the installation.



## **APPENDIX1 - REFERENCES**

### **BSI**

British Standard 8576:2013 - Guidance on investigations for ground gas – permanent gases and volatile organic compounds (VOCs).

British Standard 8485:2015+A1:2019 - Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings

### **BRE**

Protective measures for housing on gas-contaminated land. BRE Report 414. 2001. Radon: Guidance on protective measures for new buildings, BR211. 2015. BRE.

### **CIRIA**

Assessing Risks Posed by Hazardous Ground Gases to Buildings. C665. CIRIA, 2007.

### **NHBC**

Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present. 10627-R01(04). NHBC and RSK Group. NHBC , 2007.



## ENVIRONMENTAL PROTECTION

### APPENDIX 2 RECORD SHEET

NOTE: One record sheet to be completed for each plot inspected

job number	
site name / location	
plot number/s	
compiled by:	

design source/ref:		specification source/ref:		other documents attached	<input type="checkbox"/>	
building use:	residential <input type="checkbox"/>	commercial <input type="checkbox"/>	other (describe)			
building description:	no. of storeys=		detached <input type="checkbox"/>	semi-detached <input type="checkbox"/>	terrace <input type="checkbox"/>	apartment block <input type="checkbox"/>
gas protection type:	active / passive	foundation type:	suspended floor / raft / other			

Ventilated sub-floor (if present)	Inspection date/time	Inspected by	photographed
void former type	<input type="checkbox"/>	1.	
height of void space	<input type="checkbox"/>	2.	
gravel type	<input type="checkbox"/>	3.	
pipe size and spacing	<input type="checkbox"/>	4.	
external wall airbricks	<input type="checkbox"/>	5.	
internal sleeper walls	<input type="checkbox"/>	6.	
external vent trenches / ducts	<input type="checkbox"/>	7.	

Gas barrier		inspection date/time:	inspected by:
membrane type	<input type="checkbox"/>	8.	
extent of coverage	<input type="checkbox"/>	9.	
underside of membrane	<input type="checkbox"/>	10.	
slab/membrane condition	<input type="checkbox"/>	11.	
laps and joints	<input type="checkbox"/>	12.	
damp-proof course	<input type="checkbox"/>	13.	
service entries and seals	<input type="checkbox"/>	14.	
cavity inspection	<input type="checkbox"/>	15.	





**Guide notes:**

1	void former type	proprietary type - manufacturer and specification, in accordance with design?, installed properly without damage?
2	height of void space	height of proprietary former or constructed ventilation space below suspended floor - note any debris on void / obstructions to air flow, note formation surface soil type (e.g. crushed concrete/brick), any evidence of flooding
3	gravel type	gravel type, if used (limestone / granite etc.) and any specification (e.g. 6F2), typical particle dimensions (mm), apparent fines content (low/high), compaction (loose/dense), waterlogging / contamination by clay, organic matter, other debris. Take photographs of stockpile close up shot of stone with tape measure. Alternatively check details on delivery tickets for stone. Take photographs of adjacent plots if at this stage of construction. Check depth of stone conforms to at least 300mm if visible.
4	pipe size and spacing	diameter in mm; material type (e.g. PVC); slotted or perforated; positioning and spacing / separation and jointing as on design drawing - if not sketch arrangement - do pipes connect with external (telescopic / swan-neck) vents? Take photographs of vents on external walls for each plot. (May be possible to photograph other plots on site which are at stage of installing vents. Will be useful for these plots later on).
5	external wall airbricks	check numbers, size and positions as design drawing (if not shown, make sketch; check for blockage, e.g. by mortar, or soil / pavings etc.
6	internal sleeper walls	check for ventilation holes - e.g. honeycomb brickwork or pipe crossings - note size, spacing and location - in accordance with design?
7	external vent trenches / ducts	check whether located and constructed in accordance with design drawings; if open-topped gravel, note gravel type and presence of fines / contamination; if pipe or other vents - check positions and construction for functionality and absence of blockages - vents may be built over
8	membrane type	note manufacturer and product specification, including batch / roll numbers if present - in accordance with specification? Check stock storage arrangements - protected from dirt and damage?
9	extent of coverage	if membrane is incomplete, further inspection will be required - note areas completed / incomplete - is membrane fully visible or have internal walls been constructed over membrane / screed placed?
10	underside of membrane	Where necessary, for example, when using a granular blanket as a ventilation layer, check the underside of the membrane has adequate protection e.g. minimum 50mm no fines concrete blinding layer or appropriate geo-textile (see also below)

This plot has PASSED / FAILED\* inspection. (Any proposed remedial works will be noted in the 'Remarks' column on this form). An addition inspection visit IS / IS NOT\* required for this plot.

Signed:.....(Print Name) .....

\* Delete as appropriate