



Gas Protection – “The Rough guide”

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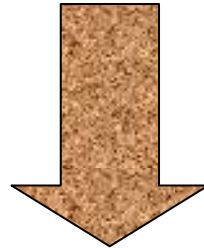


“Mankind always sets itself only such problems as it can solve;
Since, looking at the matter more closely, it will always be found that the task itself arises only when the material conditions for its solution already exist or are at least in the process of formation.”

Karl Marx - a contribution to the antique political enemy (1859)

Background

- Loscoe
- Abbeystead



- Regulation



Regulation

- Article 18 of the Town and Country General Development Order (1988)
- Waste Management Paper 27 (1991)
- In a planning context it is the developer's responsibility to ensure safe development
- Outside the planning context, risk from landfill gas contamination is now also considered within the Part IIA framework



Previously Published Guidance

•1987	BRE	100: Measurement of Gas Emissions from Contaminated Land
•1991	BRE	212: Construction of New Buildings on Gas Contaminated Land
•1991	DOE	Approved Document C (Building Regulations)
•1991	DOE	WMP 27: Landfill Gas (2nd Edition)
•1993	CIRIA	130: Methane: its occurrence and Hazards in construction
•1993	CIRIA	131: The Measurement of Methane and Other Gasses from the Ground
•1995	CIRIA	149: Protecting Development from Methane
•1995	CIRIA	150: Methane Investigation Strategies
•1995	CIRIA	152: Risk Assessment for Methane and Other Gasses from the Ground

Previously Published Guidance

•1997	DETR/PiT	Passive Venting of Soil Gases Beneath Buildings
•1998	IWM	The Monitoring of Landfill Gas (2nd Edition)
•1998	OWEN & PAUL	Methodology for the quantitative design of gas dispersal layers paper, published in Polluted and Marginal Land 1998
•1999	WILSON & CARD	Reliability and risk in gas protection design paper, published in Ground Engineering
•2001	BRE	414: Protective Measures for Housing on Gas Contaminated Land
•2003	EA	Consultation: Building Development on or within 250m of a Landfill Site (<i>consultation closed Oct 2003</i>)
•2004	ODPM	Approved Document C (Building Regulations 2000)



Recently Published Guidance

- **NHBC** - Guidance on evaluation of development proposals on sites where methane and carbon Dioxide are present Report No 10627-RO1 (04) January 2007
- **CIRIA - C665** Assessing Risks posed by hazardous ground gases to buildings 2007
- **BS8485** – Code of Practice for the characterisation and remediation from ground gas in affected developments Dec 2007

The gas contamination problem



If buildings are constructed on or near gas contaminated land there is a risk that hazardous gasses may penetrate the building and can concentrate if not allowed to escape.

Gasses which may cause problems include carbon dioxide, methane and radon. Common causes of their presence include brownfield sites, landfill and natural occurrence such as peat.



Start with the site

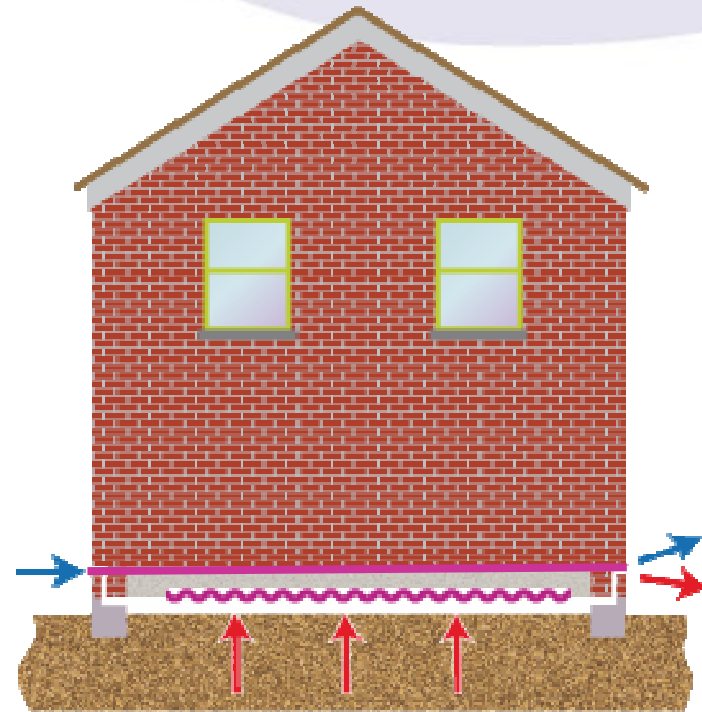


- Information is key, quality and quantity should be in line with expectations
- Analysis is based on “Gas Screening Values”
- Professional judgement should be used.
- CIRIA C665 gives excellent guidance
- Consider the receptor.
- Use Risk analysis techniques.

Housing



- **Ground bearing concrete slab**
- The slab is poured directly on to the gas barrier, below which is a venting layer. Ventilation paths must be provided from the venting layer to atmosphere
- **Suspended beam and block floors.**
- Gas barrier is laid over the structural floor and covered with a screed. The sub floor can be ventilated by air bricks



NHBC Traffic Lights

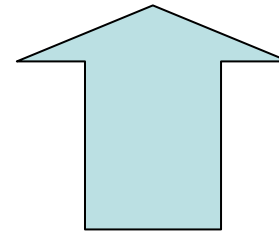


- **Green site – Ground gas protection measures not required**
- **Amber “1” site – Low to Moderate measures required**
may consist of barrier installed by ground worker to good standards and involve validation towards the upper end. Ventilation should offer 1 change in 24hrs
- **Amber “2” Site – Moderate to high measures required**
membranes should be installed by specialist contractor, involve appropriate CQA measures and should be validated, Integrity testing should be considered at the upper end. Ventilation should offer 1 change in 24 hrs as with amber “1”
- **Red site – Residential housebuilding not allowed unless the site characteristic situation can be demonstrably lowered.**

Gas barrier materials



- Aluminium foil products
- Reinforced products
- Straight polymerics



Improved
performance

...but however good the material,
this is not a benign environment

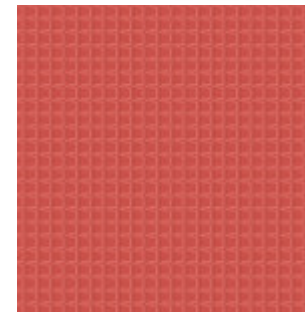
Membrane materials



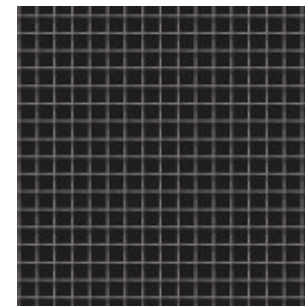
Standard

- **Standard gas barrier**
 - Reinforced LDPE membrane including aluminium foil.
 - Extremely low gas transmission.
 - Exceeds DPM standards.
 - Weldable.

- **Super gas barrier**
 - Five layer process membrane.
 - Exceeds DPM standards.
 - Extremely low gas transmission.
 - Weldable.
 - Aluminium foil core.
 - Meets BS for DPC.



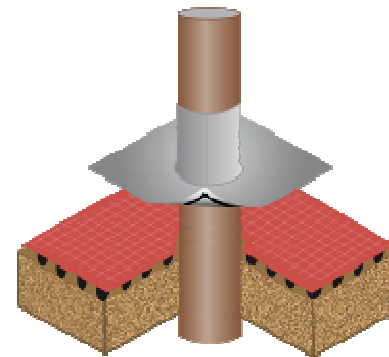
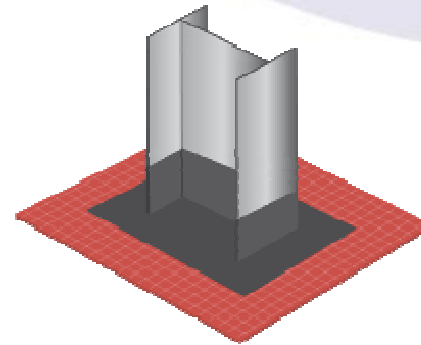
Super



Detailing is IMPORTANT



- Penetrations for services, and junctions, must be sealed
- Preformed 'Top Hat' units and adhesive membrane sections are used for this purpose



Typical House Plot Gas barrier



- Full Line Out is cost effective
- Picture Frame / Carpet Fit takes longer and is more expensive
- Integrity testing possible with full line out
- BRE 414 offers design advice / details





- The three most important elements of membrane efficiency

- **INSTALLATION**
- **INSTALLATION**
- **INSTALLATION**

How to do it well!



And How not to!



The good!



The bad!



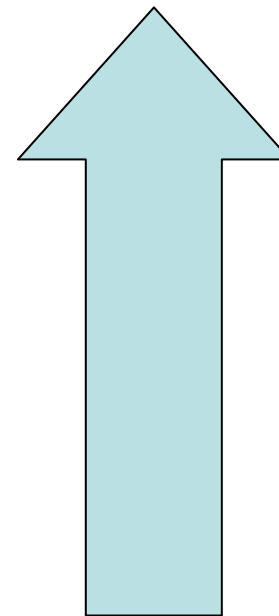
And The Ugly!



Ventilation products



- Clear void
- Polystyrene block on legs (vent form)
- Drainage composites (12-50mm)
- Gravel and pipes
- Gravel beds

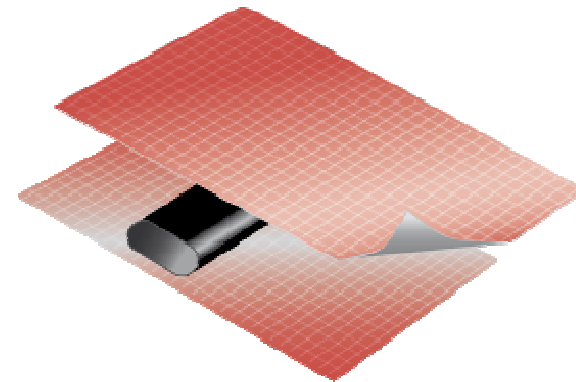


Improved performance

Ventilation & ancillary products



- Void former
 - Made from cusped High Density Polyethylene (HDPE).
 - High strength and crush resistance.
 - Available as fully wrapped or single-sided geotextile.
- Cross linked butyl sealant
 - Suitable for joining polyethylene membranes.
 - Very low gas transmission.



BS8485 Code of Practice



- Is a framework for managing ground gas risk and solutions.
- Builds on the work in C665 and the NHBC document.
- Uses “points based” system to identify levels of protection required and provided.
- Splits the protection into ventilation, slab, barrier and monitoring / validation sections.
- Is designed to offer a common approach for designers, regulators and construction professionals.

BS8485 application



- **Table 2 identifies recommended levels of gas protection for characteristic gas situations and various construction types.**

Characteristic Gas situation	NHBC Traffic light	Non Managed property E.g. private housing	Public Buildings	Commercial Buildings	Industrial Buildings
1	Green	0	0	0	0
2	Amber 1	3	3	2	1
3	Amber 2	4	3	2	2
4	Red	6	5	4	3
5			6	5	4
6				7	6

BS8485 application



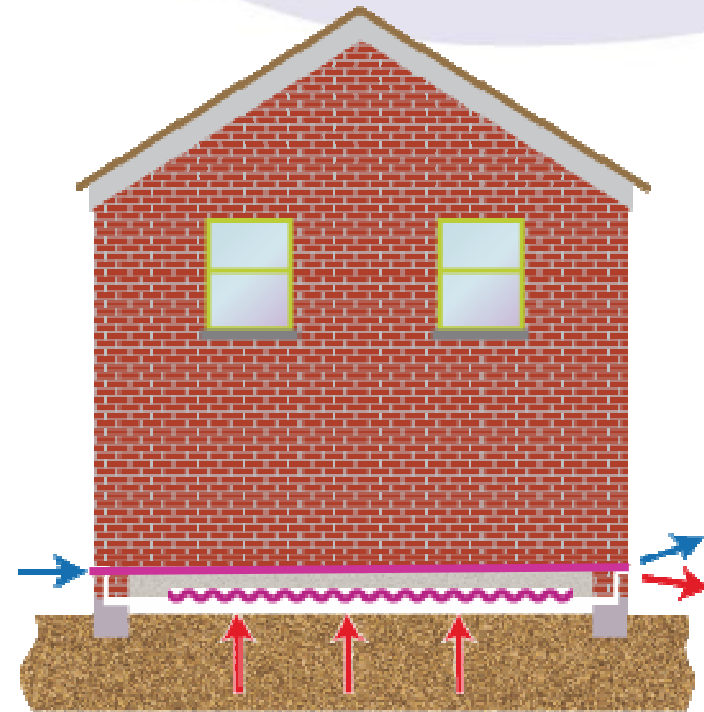
- Table 3 then identifies a range of measures which contribute to the gas protection and gives them a score
- Subsections are identified as follows
 - Ventilation
 - Floor slabs
 - Membranes (including installation)
 - Monitoring and detection
 - Pathway intervention

Scores in each appropriate section are added to give the total score for the designed solution

Housing



- **Ground bearing concrete slab**
- The slab (**0.5-1.5pts**) is poured directly on to the gas barrier, (**0.5-2.0pts**) below which is a venting layer. Ventilation paths must be provided from the venting layer to atmosphere (**0-2.5pts**)
- **Suspended beam and block floors.**
- Gas barrier (**0.5-2.0pts**) is laid over the beam & Block floor (**0pts**) and covered with a screed. The sub floor is ventilated by air bricks (**2.5pts**)



Commercial / Industrial buildings

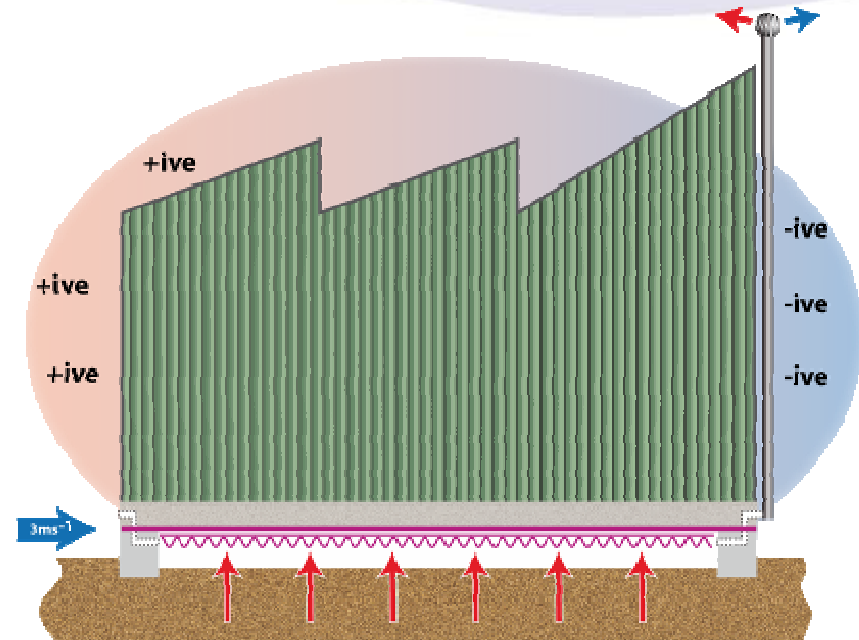


- Managed buildings offer more options
- This may apply to managed housing and offices as well as commercial and Industrial buildings.
- Consideration of the risk of the receptor is as important as the risk from the site.
- Active ventilation systems. Modular build up and monitoring allow much more flexibility of design.
- More difficult “red” sites can be easily developed
- BS8485 “scores” of up to 7 or more are possible

Simple passive



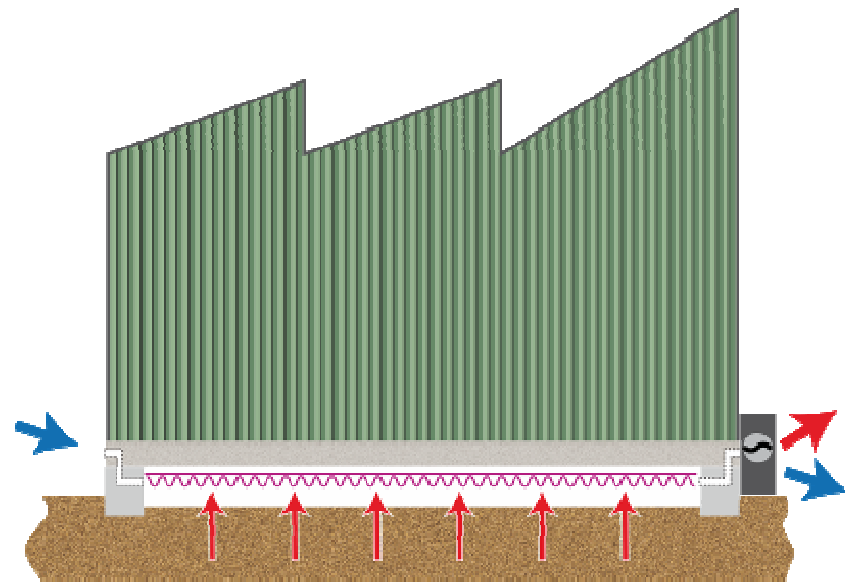
- Simple/easy to construct/various components used
- Calculation used to demonstrate performance (seldom proven)
- Wind speed variable + effect of other buildings



Full active (extract)



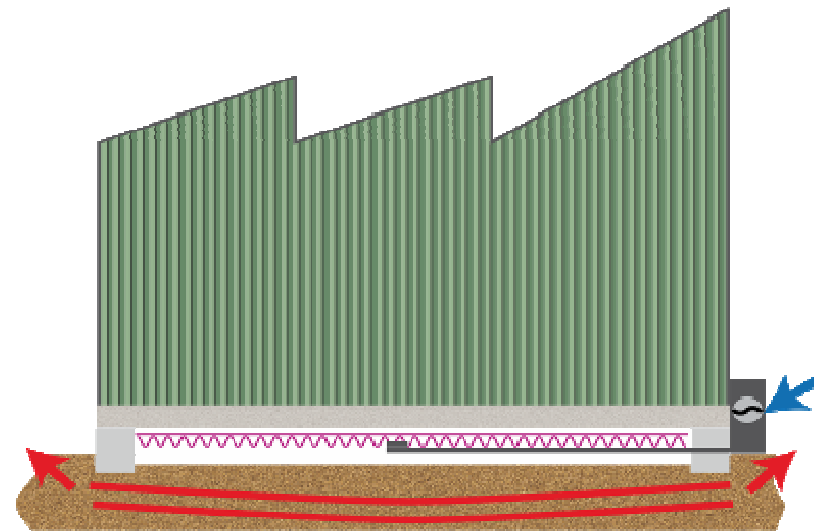
- Reduced pressure
- Intrinsically safe pumps
- Switched system
- Evacuation protocol
- Unreliable



Full active (positive)



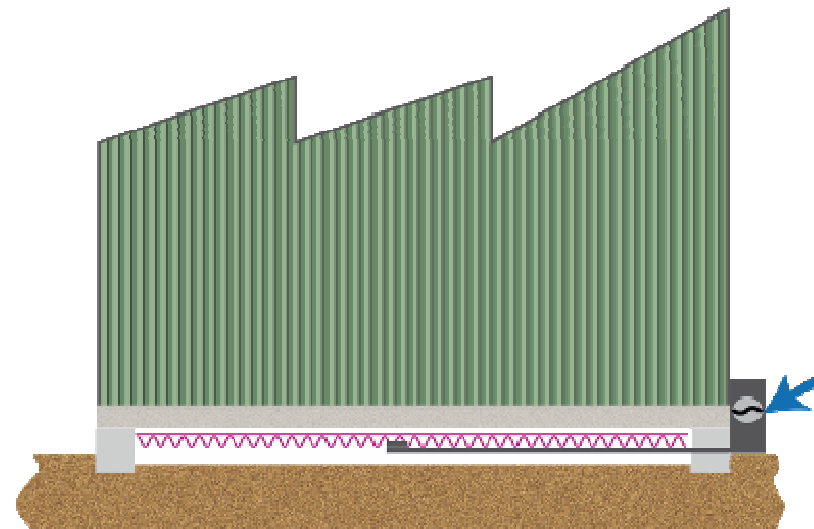
- Positive pressurisation
- Total exclusion zone
- Dilution and dispersion zone
- Simple pumps – clean air
- No switching to fail
- Geosynthetic elements only to improve efficiency and fail safe



Passive assisted



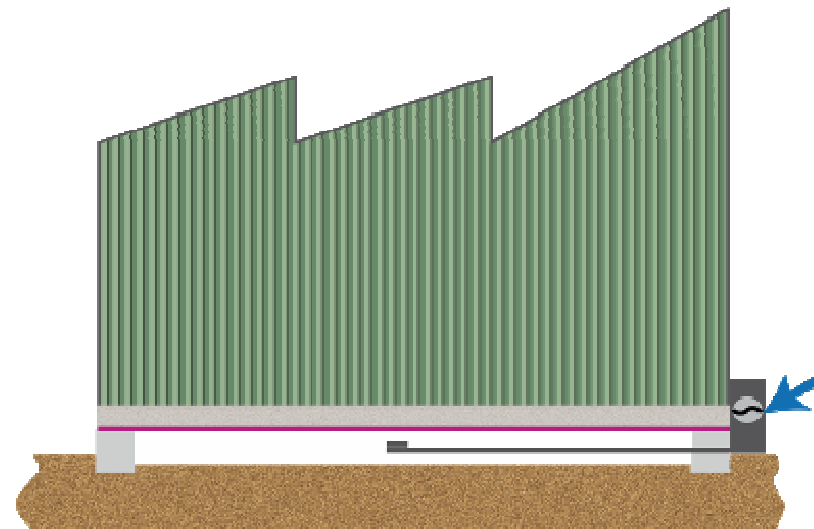
- Constant performance irrespective of wind speed
- Dilution/dispersion based on air changes
- Single geosynthetic barrier component
- Provable via probe system
- Flexible/upgradeable
- Cost effective w.r.t. well designed passive system



Low energy



- Guaranteed 100% efficiency
- Simple, fast installation
- Contaminants cannot impact with structure
- Risk removal – provable zero contaminant level beneath the building
- Reduces the necessity for propriety barriers and ventilation products
- Activates the granular sub-base with positive pressure
- Full efficacy indemnity based on provability of the system
- Modular build-up, available in various stages



In conclusion



- Regulation is driving requirements
- Solutions producers have until now capitalised on lack of clear understanding
- Provability of solutions has been spasmodic
- Current choice of solutions and new guidance will demystify the business
- 21st century solutions / advice makes risk free construction possible



“

It is exciting to have a real crisis on your hands, when you have spent half your political life dealing with humdrum issues like the environment.

”

Margaret Thatcher



Thank you

Peter Atchison

