Precast Concrete Flooring Solutions to Gas Contamination

September 2017

Precautions and incorporation of membranes and introducing passive ventilation within the precast floor design.

INTRODUCTION

This technical data sheet is produced as guidance for solving gas problems that may be encountered with new build housing.

GAS CONTAMINATION

Building regulation C1(2) states 'Reasonable precautions shall be taken to avoid danger to health and safety caused by contaminants on or in the ground covered, or to be covered by the building and any land associated with the building' (in Scotland see Regulation 16).

'Contaminant' means any substance which is or could become harmful to persons or buildings including substances which are corrosive, explosive, inflammable, radioactive, or toxic and includes deposits of faecal, animal or vegetable matter (biologically active).

METHANE

Methane is probably the most well-known gas contaminant. It is a gaseous hydrocarbon, the main constituent being natural methane. Combined with air at concentrations of 5-16% by volume, it forms an explosive mixture. Sources of methane gas are usually:

- brownfield sites where the land has been contaminated by prior industrial usage
- previous landfill where the breakdown of organic material occurs
- natural occurrence where land contains peat, coal or river silt

Anything that once lived and has died has a potential for methane emission.

RADON

Radon is an odourless, radioactive gas that occurs as a result of the natural decay cycle of uranium to lead.

Outdoors, it disperses safely into the air and presents no dangers. However, over a period of time, concentrations of radon can accumulate inside structures built on radon-generating land. Prolonged exposure to high concentrations of radon increases the risk of lung cancer. Radon is the biggest single contributor to radiation exposure of the UK population: 2,500 deaths a year are attributed to lung cancer resulting from radon.

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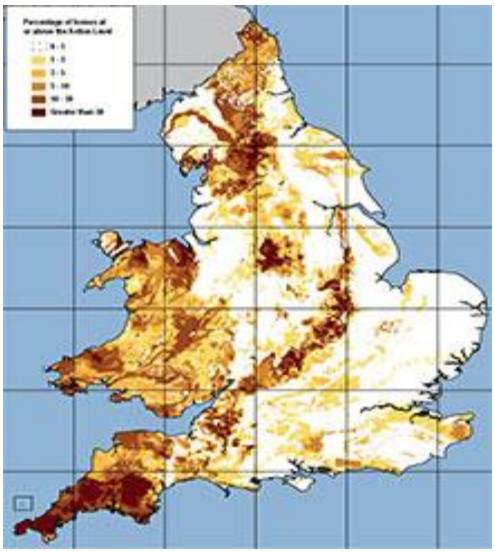
The gas occurs throughout the UK but is regarded as a particular problem in Devon, Cornwall, Derbyshire, Northampton, Somerset and parts of Scotland.

Radon concentrations are measured in becquerels per cubic metre – bq/m^3 – and government has set an action level for houses of $200bq/m^3$, above which remedial action should be taken. Higher concentrations and larger converted buildings may require maintained ventilation.



Radon Map: Public Health England: www.ukradon.org

CO_2

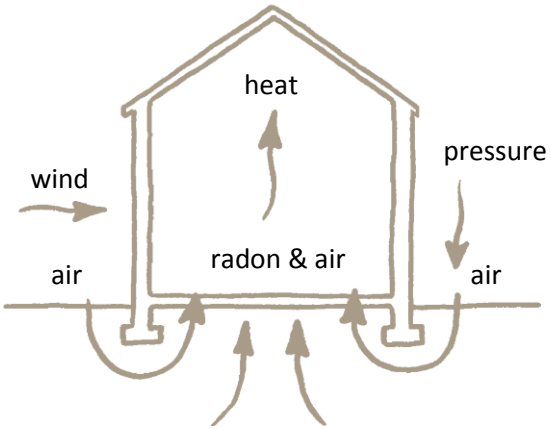
The greenhouse gas carbon dioxide (CO_2) can also be a problem on brownfield sites. The maximum permissible concentrations for this toxic, asphyxiating gas are 0.5% by volume for long-term exposure and 1.5% by volume for short-term exposure. Other hazardous gases include carbon monoxide, hydrogen sulphide and hydrogen.

BUILDING ON GAS-CONTAMINATED LAND

When buildings are constructed on gas-contaminated land, the gas will generally seep upwards through openings such as construction joints and service penetrations and build up to dangerous concentrations if it becomes trapped. The key phrase here is “if it becomes trapped”, in which case there are two stages to control the situation. The first is to make sure that gas is separated from the living area of the building by a membrane and the second is to evacuate the gas continuously to the outside of the building where it will rapidly disperse into the atmosphere.

Gas flows into buildings as a result of:

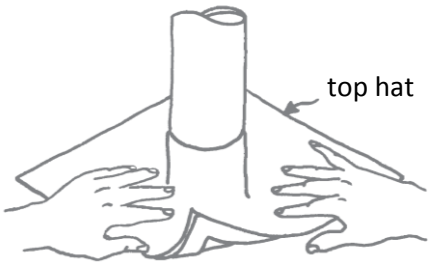
- the pressure of ongoing gas production;
- the stack effect;
- the wind, and
- groundwater movement.



Gas control systems are designed to prevent the ingress of dangerous gases into new build projects.

The solution to such gas penetration is precast concrete flooring above a vented plenum. The concrete forms an efficient barrier to the gas when incorporating a membrane, while natural underfloor ventilation by way of vents and airblocks avoids any potential build-up.

Penetration points due to services are sealed with top hats and joints in the membrane are sealed with tape. The micro-porous seepage through these membranes is almost negligible. Any precast concrete system can be used with the incorporation of a gas membrane.

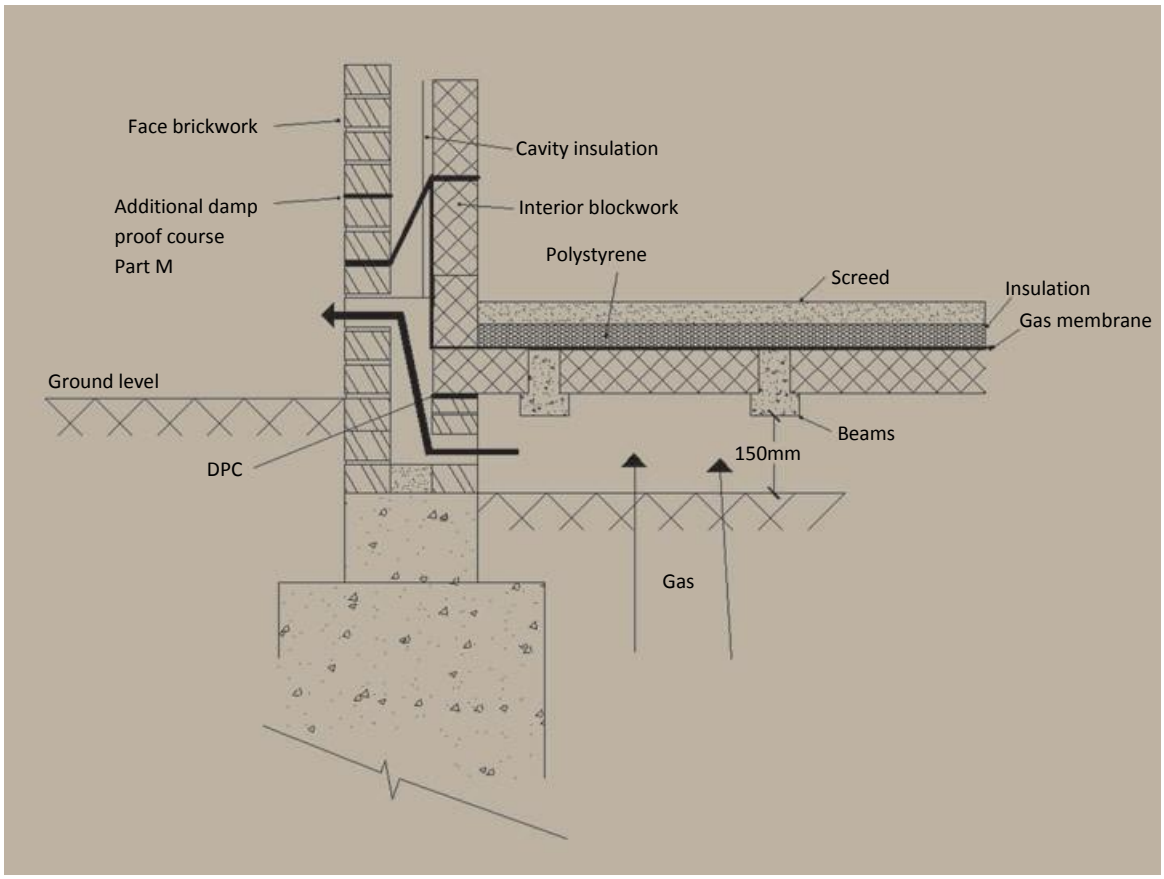


Party walls with cavity construction need to be sealed with a membrane and the void beneath ventilated.

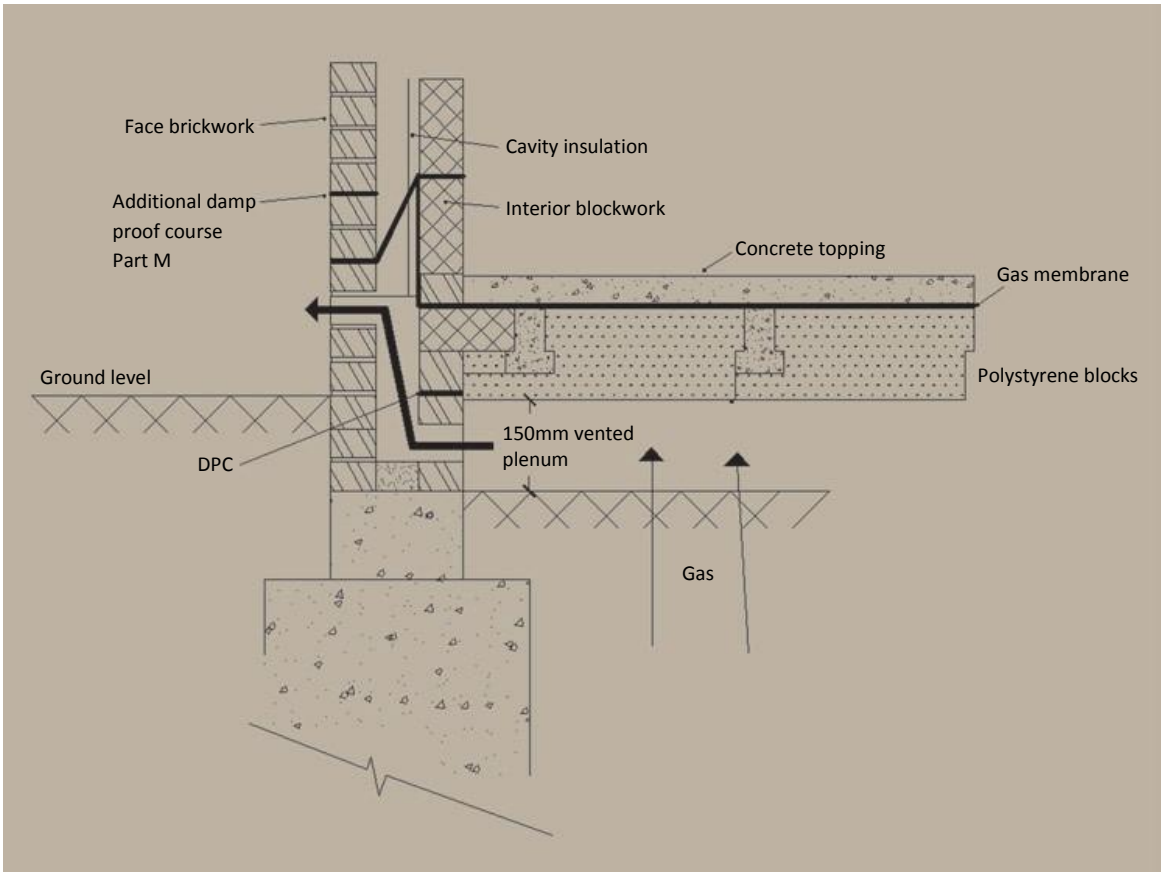
Interior foundations need to be honeycomb or constructed in order to ensure cross flow ventilation between the high pressure and low pressure zones of the house.

All cavities in excess of 0.00042m^3 (or the equivalent 75mm x 75mm x 75mm) need to be ventilated.

Beam and concrete flooring block, with insulated overlayer
Typical passive gas emission shown by crossfloor ventilation.



Beam and insulated flooring block
Typical passive gas emission shown



In any confined area, dry stack ventilation may be considered.