Development & Planning Authority

# Guernsey Technical Standard

## Site preparation and resistance to contaminants and moisture

**The Building (Guernsey) Regulations, 2012**

# C

**C1 Preparation of the site and resistance to contaminants**
**C2 Resistance to moisture**

2012 edition
With May 2016 amendments

## MAIN CHANGES MADE BY THE MAY 2016 AMENDMENTS

1. Text changes made to reflect the new structure of government post May 1st 2016. All references to Departments have been removed.

## MAIN CHANGES MADE BY THE FEB 2013 AMENDMENTS

2. The general guidance on materials and workmanship and the Construction Products Directive has been edited to reflect the new EU Construction Products Regulation.

## MAIN CHANGES IN THE 2012 EDITION

3. This Guernsey Technical Standard which comes into effect on 1st July 2012 is issued under the Building (Guernsey) Regulations, 2012. From this date all previous editions of documents approved under the Building Regulations, 1992 i.e. (the UK Approved Document C 2004) will no longer be valid except in relation to building work carried out in accordance with full plans deposited with the States of Guernsey Building Control before that date.

## How this Guernsey Technical Standard C differs from the UK Approved Document C

4. In addition to the different legislative references reflecting Guernsey legislation, the main differences a non resident based applicant should note is a single exposure rate specific to Guernsey has been included in this document

5. The UK Building (Approved Inspectors, etc.) Regulations 2010 are not in force in Guernsey. Therefore approved inspectors are not recognised on the Island and all references have been removed.

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# Introduction

## What is a Guernsey Technical Standard?

This document has been approved and issued by the Development and Planning Authority to provide practical guidance on ways of complying with requirements C1 to C2 and regulation 11 of the Building (Guernsey) Regulations, 2012 (GSI 2012 No.11) . The Building (Guernsey) Regulations, 2012 are referred to throughout the remainder of this document as 'the Building Regulations'.

The intention of issuing Guernsey Technical Standards is to provide guidance about compliance with specific aspects of the Building Regulations in some of the more common building situations. They include examples of what, in ordinary circumstances, may be reasonable provision for compliance with the relevant requirement(s) of the Building Regulations to which they refer.

If guidance in a Guernsey Technical Standard is followed this may be relied upon as tending to show compliance with the requirement(s) covered by the guidance. Similarly a contravention of the standard may be relied upon as tending to establish a breach of the requirements. However, this is not conclusive, so simply following guidance does not guarantee compliance in an individual case or a failure to follow it meaning that there is necessarily a breach. It is also important to note that there may well be other ways of achieving compliance with the requirements. There is therefore no obligation to adopt any particular solution contained in this Guernsey Technical Standard if you would prefer to meet the relevant requirement in some other way. However, persons intending to carry out building work should always check with Building Control, that their proposals comply with Building Regulations.

The guidance contained in this Guernsey Technical Standard relates only to the particular requirements of the Building Regulations that the document addresses, (see 'Requirements' below). However, building work may be subject to more than one requirement of the Building Regulations and there may be an obligation to carry out work on a material change of use. In such cases the works will also have to comply with any other applicable requirements of the Building Regulations and work may need to be carried out which applies where a material change of use occurs.

This document is one of a series that has been approved and issued for the purpose of providing practical guidance with respect to the requirements of the Building Regulations in particular of regulations 6, 8 and 11 and Schedule 1.

At the back of this document is a list of all the documents that have been approved and issued for this purpose.

## How to use this Guernsey Technical Standard

In this document the following conventions have been adopted to assist understanding and interpretation:

a. Texts shown against a yellow background are extracts from the Building Regulations, and set out the legal requirements that relate to compliance with the **site preparation and resistance to contaminants and moisture** requirements of the Building Regulations. It should be remembered however that, as noted above, building works must comply with all the other applicable provisions of the Building Regulations.

b. Key terms are defined in annex B at the rear of this document.

c. Details of technical publications referred to in the text of this document will be presented in ***italics*** and repeated in standards referred to as an annex at the rear of this document. A reference to a publication is likely to be made for one of two main reasons. The publication may contain additional or more comprehensive technical detail, which it would be impractical to include in full in this Document but which is needed to fully explain ways of meeting the requirements; or it is a source of more general information. The reason for the reference will be indicated in each case. The reference will be to a specified edition of the document. The Guernsey Technical Standard may be amended from time to time to include new references or to refer to revised editions where this aids compliance.

## Where you can get further help

If you require clarification of any of the technical guidance or other information set out in this Guernsey Technical Standard and the additional detailed technical references to which it directs you, there are a number of routes through which you can seek further assistance:

– The States of Guernsey website: **www.gov.gg/planning**

– If you are the person undertaking the building work you can seek advice from Building Control Surveyors to help ensure that, when carried out, your work will meet the requirements of the Building Regulations.

– Businesses registered with a competent person self-certification scheme may be able to get technical advice from their scheme operator. A full list of competent persons schemes are included as Schedule 3 of the Building Regulations.

– If your query is of a highly technical nature you may wish to seek the advice of a specialist, or industry technical body, in the area of concern.

## Responsibility for compliance

It is important to remember that if you are the person (e.g. designer, builder, installer) carrying out building work to which any requirement of Building Regulations applies you have a responsibility to ensure that the work complies with any such requirement. The building owner or occupier will also have a responsibility for ensuring compliance with Building Regulation requirements and could be served with a compliance notice in cases of non-compliance or with a challenge notice in cases of suspected non-compliance.

# General Guidance

## Types of work covered by this Guernsey Technical Standard

### Building work

Building work, as defined in regulation 5 of the Building (Guernsey) Regulations, 2012, includes the erection or extension of a building, the provision or extension of a controlled service or fitting, and the material alteration of a building or a controlled service or fitting. In addition, the Building Regulations may apply in cases where the purposes for which, or the manner or circumstances in which, a building or part of a building is used change in a way that constitutes a material change of use.

Under regulation 6 of the Building Regulations 2012, building work must be carried out in such a way that, on completion of work,

i. the work complies with the applicable Parts of Schedule 1 of the Building Regulations,

ii. in the case of an extension or material alteration of a building, or the provision, extension or material alteration of a controlled service or fitting, it complies with the applicable Parts of Schedule 1 to the Building Regulations and also does so as satisfactorily as it did before the work was carried out.

Work described in Part C concerns the site preparation and resistance to contaminants and moisture. Work associated with site preparation and resistance to contaminants and moisture covered in these sections may be subject to other relevant Parts of the Building Regulations.

## Material change of use

A material change of use occurs in specified circumstances in which a building, or part of a building that was previously used for one purpose will be used in future for another, or is converted to a building of another kind. Where there is a material change of use, the Building Regulations set requirements that must be met before the building can be used for its new purpose.

Regulation 7 of the Building (Guernsey) Regulations, 2012 specifies the following circumstances as material changes of use:

- a building is used as a dwelling where previously it was not,
- a building contains a flat where previously it did not,
- a building is used as an institution where previously it was not,
- a building is used as a public building where previously it was not,
- a building is not described in Classes I to V or VI of Schedule 2, where previously it was,
- a building contains a room for residential purposes where previously it did not,
- a building contains an office where previously it did not,
- a building is used as an hotel or guest house, where previously it was not,
- a building is an industrial building, where previously it was not,
- a building contains a shop, where previously it did not,
- a building is used for the sale of food or drink, to the public in the course of a business and for consumption in that building and where there is a maximum capacity of 15 or more persons seated or standing, where previously it was not so used,
- the building, which contains at least one room for residential purposes, contains a greater or lesser number of such rooms than it did previously,

– the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously.

Part C2 will apply to all the material changes of use mentioned above. This means that whenever such changes occur the building must be brought up to the standards required by Part C2.

Part C1(2) will apply only to the material changes of use where a building is used as a dwelling, a flat, an institution, a public building, or contains rooms for residential purposes, will be used as an hotel, contains a greater or lesser number of rooms for residential purposes, or a greater or lesser number of dwellings, than it did previously.

## Protected Buildings and Monuments

The types of building works covered by this Guernsey Technical Standard may include work on historic buildings. Historic buildings include:

a. a building appearing on the protected buildings listing

b. a building or other structure appearing on the protected monument listing

When exercising its functions under The Land Planning and Development Law, the States has duties under s30(1), 34, 35 and 38(1) of that Law, to secure so far as possible that monuments are protected and preserved, that the special characteristics of protected buildings are preserved and to pay special attention to the desirability of preserving and enhancing the character and appearance of a conservation area. Building Control will need to comply with these duties when considering any decisions in relation to such buildings or buildings in such areas.

Special considerations may apply if the building on which the work is to be carried out has special historic, architectural, traditional or other interest, and compliance with the **site preparation and resistance to contaminants and moisture** requirements would unacceptably alter the fabric, character or appearance of the building or parts of it.

When undertaking work on or in connection with buildings with special historic, architectural, traditional or other interest, the aim should be to improve the **site preparation and resistance to contaminants and moisture** where and to the extent that it is possible provided that the work does not prejudice the fabric, character or appearance of the host building or increase the long-term deterioration to the building's fabric or fittings.

In arriving at a balance between historic building conservation and the **site preparation and resistance to contaminants and moisture** requirements advice should be sought from the historic building adviser.

**Note:** Any building which is a protected monument listed under Section 29 of The Land Planning and Development (Guernsey) Law 2005 is exempt from most Building Regulations requirements including those in Part C, (See regulation 13 and class V of Schedule 2 to the Building Regulations) unless the proposed works constitute a material change of use.

## Notification of work

In almost all cases of new building work it will be necessary to notify Building Control in advance of any work starting. The exception to this: where work is carried out under a self-certification scheme listed in Schedule 3 or where works consist of emergency repairs.

## Competent person self-certification schemes under Schedule 3

Under regulations 14(4), 17(4) and 19 of the Building Regulations it is not necessary to deposit plans or notify Building Control in advance of work which is covered by this Guernsey Technical Standard if that work is of a type set out in column 1 of Schedule 3 to the Regulations and is carried out by a person registered with a relevant self-certification (competent persons) scheme as set out in column 2 of that Schedule. In order to join such a scheme a person must demonstrate competence to carry out the type of work the scheme covers, and also the ability to comply with all relevant requirements in the Building Regulations. These schemes may change from time to time, or schemes may change name, or new schemes may be authorised under Schedule 3; the current list on the States's website should always be consulted. Full details of the schemes can be found on the individual scheme websites.

Where work is carried out by a person registered with a competent person scheme, regulation 19 of the Building Regulations requires that the occupier of the building be given, within 30 days of the completion of the work, a certificate confirming that the work complies with all applicable Building Regulation requirements. There is also a requirement that Building Control be given a notice that this has been done, or the certificate, again within 30 days of the completion of the work. These certificates and notices are usually made available through the scheme operator.

Building Control is authorised to accept these certificates as evidence of compliance with the requirements of the Building Regulations. However, inspection and enforcement powers remain unaffected, although they are normally used only in response to a complaint that work may not comply.

## Exemptions

Schedule 2 to the Building Regulations sets out a number of classes of buildings which are exempt from majority of Building Regulations requirements including Part C.

## Materials and workmanship

Any building work within the meaning of the Building Regulations should, in accordance with regulation 11, be carried out with proper materials and in a workmanlike manner.

You may show that you have complied with regulation 11 in a number of ways. These include the appropriate use of a product bearing CE marking in accordance with the Construction Products Regulation (305/2011/EU-CPR) as or a product complying with an appropriate technical specification (as defined in those Regulations), a British Standard or an alternative national technical specification of any state which is a contracting party to the European Economic Area which in use is equivalent, or a product covered by a national or European certificate issued by a European Technical Approval issuing body, and the conditions of use are in accordance with the terms of the certificate.

You will find further guidance in the Guernsey Technical Standard on materials and workmanship that provides practical guidance on regulation 11 on materials and workmanship.

## Supplementary guidance

Building Control occasionally issues additional material to aid interpretation of the guidance in Guernsey Technical Standards. This material may be conveyed in official letters to relevant agents and/or posted on the States website accessed through: **www.gov.gg/planning**

## Technical specifications

When a Guernsey Technical Standard makes reference to specific standards or documents, the relevant version of the standard is the one listed at the end of the publication. However, if this version of the standard has been revised or updated by the issuing standards body, the new version may be used as a source of guidance provided that it continues to address the relevant requirements of the Building Regulations.

Where it is proposed to work to an updated version of the standard instead of the version listed at the end of the publication, this should be discussed with Building Control in advance of any work starting on site.

The appropriate use of any product, which complies with a European Technical Approval as defined in the Construction Products Regulation, (305/2011/EU-CPR) as amended, repealed or replaced will meet the relevant requirements.

## Independent schemes of certification and accreditation

Much of the guidance throughout this document is given in terms of performance.

Since the performance of a system, product, component or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and accreditation of installers and maintenance firms will provide confidence in the appropriate standard of workmanship being provided.

Confidence that the required level of performance can be achieved will be demonstrated by the use of a system, material, product or structure which is provided under the arrangements of a product conformity certification scheme and an accreditation of installer scheme.

Third party accredited product conformity certification schemes not only provide a means of identifying materials and designs of systems, products and structures which have demonstrated that they reach the requisite performance, but additionally provide confidence that the systems, materials, products and structures are actually provided to the same specification or design as that tested or assessed.

Third party accreditation of installers of systems, materials, products and structures provides a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance.

Many certification bodies that approve such schemes are accredited by the **United Kingdom Accreditation Service**.

Certification of products, components, materials or structures under such schemes may be accepted as evidence of compliance with the relevant standard. Similarly the certification of installation or maintenance of products, components, materials and structures under such schemes as evidence of compliance with the relevant standard may be acceptable. Nonetheless Building Control will wish to establish in advance of the work, that any such scheme is adequate for the purpose of the Building Regulations.

## Interaction with other legislation

This Guernsey Technical Standard makes reference to other legislation, including that listed below, the requirements of which may be applicable when carrying out building work. All references are to legislation as amended or repealed and replaced.

**Note:** All Laws, Ordinances and Statutory instruments can be accessed at;

**www.guernseylegalresources.gg/**

**The Health and Safety at Work (General) (Guernsey) Ordinance, 1987** made under the Health and Safety at Work etc. (Guernsey) Law, 1979 and the Health, Safety and Welfare of Employees Law, 1950 applies to any workplace or part of a workplace. It applies to the common parts of flats and similar buildings if people such as cleaners, wardens and caretakers are employed to work in these common parts.

**Environmental Pollution (Guernsey) Law, 2004** and the **Environmental Pollution (Waste Control and Disposal) Ordinance, 2010**

## Mixed use development

In mixed use developments part of a building may be used as a dwelling while another part has a non-domestic use. In such cases, if the requirements of this Part of the Regulations for dwellings and non-domestic use differ, the requirements for non-domestic use should apply in any shared parts of the building.

## The Requirements

This Guernsey Technical Standard deals with the following requirements from Part C of Schedule 1 of the Building Regulations

| *Requirement* | *Limits on application* |
|---|---|
| **Site preparation and resistance to contaminants and moisture**<br><br>**Preparation of site and resistance to contaminants.**<br><br>**C1.** (1) The ground to be covered by the building must be reasonably free from any material that might damage the building or affect its stability, including vegetable matter, topsoil and pre-existing foundations.<br><br>(2) Reasonable precautions must 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.<br><br>(3) Adequate subsoil drainage must be provided, if it is needed to avoid-<br><br>(a) the passage of ground moisture to the interior of the building, or<br><br>(b) damage to the building, including damage through the transport of water-borne contaminants to the foundations of the building.<br><br>(4) For the purposes of this requirement, "**contaminant**" means any substance, which is or may become harmful to persons or buildings including substances, which are corrosive, explosive, flammable, radioactive or toxic.<br><br>**Resistance to moisture**<br><br>**C2.** The walls, floors and roof of the building must adequately protect the building and people who use the building from harmful effects caused by-<br><br>(a) ground moisture,<br><br>(b) precipitation and wind-driven spray,<br><br>(c) interstitial and surface condensation, and<br><br>(d) spillage of water from or associated with sanitary fittings or fixed appliances. | |

# Guidance

## Performance

**C.1** The requirements of C1 will be met by making reasonable provisions to secure the health and safety of persons in and about the building, and by safeguarding them and buildings against adverse effects of:

a. unsuitable material including vegetable matter, topsoil and pre-existing foundations;

b. contaminants on or in the ground covered, or to be covered, by the building and any land associated with the building; and

c. groundwater.

**C.2** The requirements of C2 will be met if the floors, walls and roof are constructed to protect the building and secure the health and safety of persons in and about the building from harmful effects caused by:

a. moisture emanating from the ground or from groundwater;

b. precipitation and wind-driven spray;

c. interstitial and surface condensation; and

d. spillage of water from or associated with sanitary fittings and fixed appliances.

## Introduction to Provisions

**C.3** Sections 1, 2 and 3 of this document cover Requirement C1 and deal with site preparation and resistance to contaminants under the headings 'Clearance or treatment of unsuitable material', 'Resistance to contaminants' and 'Subsoil drainage'. Building Regulations are made for the purposes of securing the health, safety, welfare and convenience of persons in and about buildings. This means that action may need to be taken to mitigate the effects of contaminants within the land associated with the building as well as protecting the building and persons in and about the building.

**C.4** Hazards associated with the ground may include the effects of vegetable matter including tree roots. They may include health hazards associated with chemical and biological contaminants, and gas generation from biodegradation of organic matter. Hazards to the built environment can be physical, chemical or biological. Items such as underground storage tanks or foundations may create hazards to both health and the building. Physical hazards also include unstable fill or unsuitable hardcore containing sulphate.

**C.5** In addition, the naturally occurring radioactive gas radon and gases produced by some soils and minerals can be a hazard.

**C.6** Sections 4, 5 and 6 of this document cover Requirement C2 and deal with resistance to moisture under the headings 'Floors', 'Walls' and 'Roofs'. Moisture can rise from the ground to damage floors and the base of walls on any site, although much more severe problems can arise in sites that are liable to flooding. Driving rain or wind-driven spray from the sea or other water bodies adjacent to the building can penetrate walls or roofs directly, or through cracks or joints between elements, and damage the structure or internal fittings or equipment. Surface condensation from the water vapour generated within the building can cause moulds to grow which pose a health hazard to occupants. Interstitial condensation may cause damage to the structure. Spills and leaks of water, in rooms where sanitary fittings or fixed appliances that use water are installed (e.g. bathrooms and kitchens), may cause damage to floor decking or other parts of the structure.

**C.7** The diagrams in this Guernsey Technical Standard have been set out to show typical situations and relationships between adjacent elements of construction. Conventional notations and hatching have been used to identify different materials. However, the diagrams cannot show specific situations. It remains the responsibility of the designer and builder to ensure that the building work meets all relevant aspects of the Building Regulations.

## Flood risk

**C.8** Generally development should not take place in areas that are at risk of flooding. Flood resistance is not currently a requirement in Schedule 1 of the Building Regulations 2000. However, when local considerations necessitate building in flood prone areas the buildings can be

constructed to mitigate some effects of flooding such as:

a. elevated groundwater levels or flow of subsoil water across the site – this can be alleviated by the provision of adequate sub-soil drainage (see Section 3);

b. sewer flooding due to backflow or surcharging of sewers or drains – this can be addressed through the use of non-return valves and anti-flooding devices (see Section 3, paragraph 3.6);

c. intrusion of groundwater through floors – this can be addressed through the use of water resistant construction (see Section 4, paragraphs 4.7 to 4.12);

d. entry of water into floor voids – provision to inspect and clear out sub-floor voids can be considered (see Section 4, paragraph 4.20).

Further information on flood resistant construction can be found in the following publications;.

*Preparing for floods: interim guidance for improving the flood resistance of domestic and small business properties, ODPM, 2002.*

*BRE for Scottish Office Design guidance on flood damage for dwellings, 1996.*

*CIRIA/Environment Agency Flood products. Using flood protection products – a guide for home owners, 2003. Available from: www.ciria.org/flooding.*

## Land affected by contaminants

**C.9** The guidance given on resistance to contaminants in Section 2 is for the purposes of the Building Regulations and their associated requirements. Users of this document should be aware that there may be further provisions for dealing with contaminants contained in planning guidance or legislation made under the regime set out in the Environmental Pollution (Guernsey) Law, 2004 which will be supplementary to the requirements of the Building Regulations.

Where contaminants are removed, treated or contained as part of the construction works, the Environmental Pollution (Guernsey) Law, 2004 and the Environmental Pollution (Waste Control and Disposal) Ordinance, 2010 apply. If waste is removed for off-site disposal, the 'Duty of Care' and/or special controlled waste requirements will apply and operators will require a license for transportation and for management of the contaminated waste.

## States services that should be notified about contamination

**C.10** Other States services may have an interest in land affected by contamination. It may be necessary at any stage of the site investigation, risk assessment or remediation process to notify any unexpected events or change in outcomes to these regulatory authorities. The most likely situations are:

- The office of Environmental Health and Pollution Regulation should be informed if contaminants are found on a site where the presence of contamination has not been formally recognised through the planning process, if it is found that contaminants from the site are affecting other land or if contaminants are reaching the site from neighbouring land. Additional discussions may also be required if the contamination identified differs from that which has been previously discussed and agreed with Building Control or the office of Environmental Health and Pollution Regulation.
- As redevelopment is the most favoured means of dealing with land affected by contaminants, all land quality issues should be set out in documents in support of planning approval. As designs are refined it may be necessary to inform planning services of any impacts the design changes may have on the risk assessment and remediation strategy.
- Some remedial measures may themselves require prior authorisation from the Planning Services including abstraction for groundwater treatment and waste management for a number of activities involving contaminated soils.
- Working on contaminated land can be hazardous. The risks should be assessed to meet the requirements of the Health and Safety at Work etc. (Guernsey) Law, 1979 and the Health, Safety and Welfare of Employees Law, 1950. It may be necessary to give notice to the Health and Safety Executive prior to work starting.

# Section 1 - Clearance or treatment or unsuitable material

Specific guidance on the assessment of land affected by contaminants is set out in Annex A.

## Site Investigation

**1.1** The preparation of the site will depend on the findings of the site investigation. The site investigation is relevant to Sections 1, 2 and 3 of this Guernsey Technical Standard and also to the requirements of Guernsey Technical Standard A with respect to foundations. The site investigation should consist of a number of well-defined stages:

a. Planning stage. Clear objectives should be set for the investigation, including the scope and requirements, which enable the investigation to be planned and carried out efficiently and provide the required information;

b. Desk study. A review of the historical, geological and environmental information about the site is essential;

c. Site reconnaissance or walkover survey. This stage of the investigation facilitates the identification of actual and potential physical hazards and the design of the main investigation;

d. Main investigation and reporting. This will usually include intrusive and non-intrusive sampling and testing to provide soil parameters for design and construction. The main investigation should be preceded by (b) and (c) above.

**1.2** The extent and level of investigation need to be tailored to the type of development and the previous use of land. Typically the site investigation should include susceptibility to groundwater levels and flow, underlying geology, and ground and hydro-geological properties. A geotechnical site investigation should identify physical hazards for site development, determine an appropriate design and provide soil parameters for design and construction. British Standard *BS 5930:1999 Code of practice for site investigations* provides comprehensive guidance on site investigations. Guidance on site investigation for low-rise buildings is given in six *BRE* Digests;

*BRE Digest 322 Site investigation for low-rise building: procurement, 1987.*

*BRE Digest 318 Site investigation for low-rise building: desk studies, 1987.*

*BRE Digest 348 Site investigation for low-rise building: the walk-over survey, 1989.*

*BRE Digest 381 Site investigation for low-rise building: trial pits, 1993.*

*BRE Digest 383 Site investigation for low-rise building: soil description, 1993.*

*BRE Digest 411 Site investigation for low-rise building: direct investigations, 1995.*

Reference should also be made to *BS 8103-1:1995 Structural design for low rise buildings.*

**1.3** Where the site is potentially affected by contaminants, a combined geotechnical and geo-environmental investigation should be considered. Guidance on assessing and remediating sites affected by contaminants is given in Section 2: Resistance to contaminants.

## Unsuitable Material

**1.4** Vegetable matter such as turf and roots should be removed from the ground to be covered by the building at least to a depth to prevent later growth. The effects of roots close to the building also need to be assessed. Consideration should be given to whether this provision need apply to a building used wholly for:

a. storing goods, provided that any persons who are habitually employed in the building are engaged only in taking in, caring for or taking out the goods; or

b. a purpose such that the provision would not serve to increase protection to the health or safety of any persons habitually employed in the building.

**1.5** Building services such as below ground drainage should be sufficiently robust or flexible to accommodate the presence of any tree roots. Joints should be made so that roots will not penetrate them. Where roots could pose a hazard to building services, consideration should be given to their removal.

**1.6** On sites previously used for buildings, consideration should be given to the presence of existing foundations, services, buried tanks and any other infrastructure that could endanger persons in and about the building and any land associated with the building.

**1.7** Where the site contains fill or made ground, consideration should be given to its compressibility and its potential for collapse on wetting, and to appropriate remedial measures to prevent damaging differential settlement. Guidance is given in *BRE Digest 427 Low-rise buildings on fill* and *BRE Report BR 424 Building on fill: Geotechnical aspects, 2001.*

# Section 2 - Resistance to contaminants

## Introduction

**2.1** A wide range of solid, liquid and gaseous contaminants can arise on sites, especially those that have had a previous industrial use (see Annex C for the definition of a contaminant). In particular, the burial of biodegradable waste in landfills can give rise to landfill gas (see paragraph 2.23). Sites with a generally rural use such as agriculture or forestry may be contaminated by pesticides, fertiliser, fuel and oils and decaying matter of biological origin.

**2.2** Table 1 lists examples of sites that are likely to contain contaminants. It is derived from the 'Industry Profile' guides produced by the UK's former Department of the Environment (DoE), each of which deals with a different industry with the potential to cause contamination. Each profile identifies contaminants which may be associated with the industry, areas on the site in which they may be found and possible routes for migration.

**2.3** Natural contaminants include the radioactive gas radon, although the specific approach for assessing and managing the risks it poses is different from other contaminants (see paragraphs 2.37 to 2.39).

**2.4** Sulphate attack affecting concrete floor slabs and oversite concrete associated with particular strata also needs to be considered. *BRE Special Digest SD1 Concrete in aggressive ground, 2003* provides guidance on investigation, concrete specification and design to mitigate the effects of sulphate attack.

Table 1 **Examples of sites likely to contain contaminants**

| |
|---|
| Animal and animal products processing works |
| Asbestos works |
| Ceramics, cement and asphalt manufacturing works |
| Chemical works |
| Dockyards and dockland |
| Engineering works |
| Gas works, coal carbonisation plants and ancillary by-product works |
| Industries making or using wood preservatives |
| Landfill and other waste disposal sites |
| Metal mines, smelters, foundries, steel works and metal finishing works |
| Munitions production and testing sites |
| Oil storage and distribution sites |
| Paper and printing works |
| Power stations |
| Road vehicle fuelling, service and repair: garages and filling stations |
| Scrap yards |
| Sewage works, sewage farms and sludge disposal sites |
| Tanneries |
| Textile works and dye works |

**Note**: the above list is not exhaustive

## Solid and liquid contaminants

## Risk assessment

### General concepts

**2.5** To ensure safe development of land affected by contaminants the principles of risk assessment (as set out in paragraph 2.7 below) should be followed. The general approach is founded on the concept of the 'source–pathway–receptor' relationship, or pollutant linkage, where source refers to contaminants in or on the ground. This is illustrated by the conceptual model in Diagram 1.

**2.6** When land affected by contaminants is developed, receptors (i.e. buildings, building materials and building services, as well as people) are introduced onto the site and so it is necessary to break the pollutant linkages. This can be achieved by:

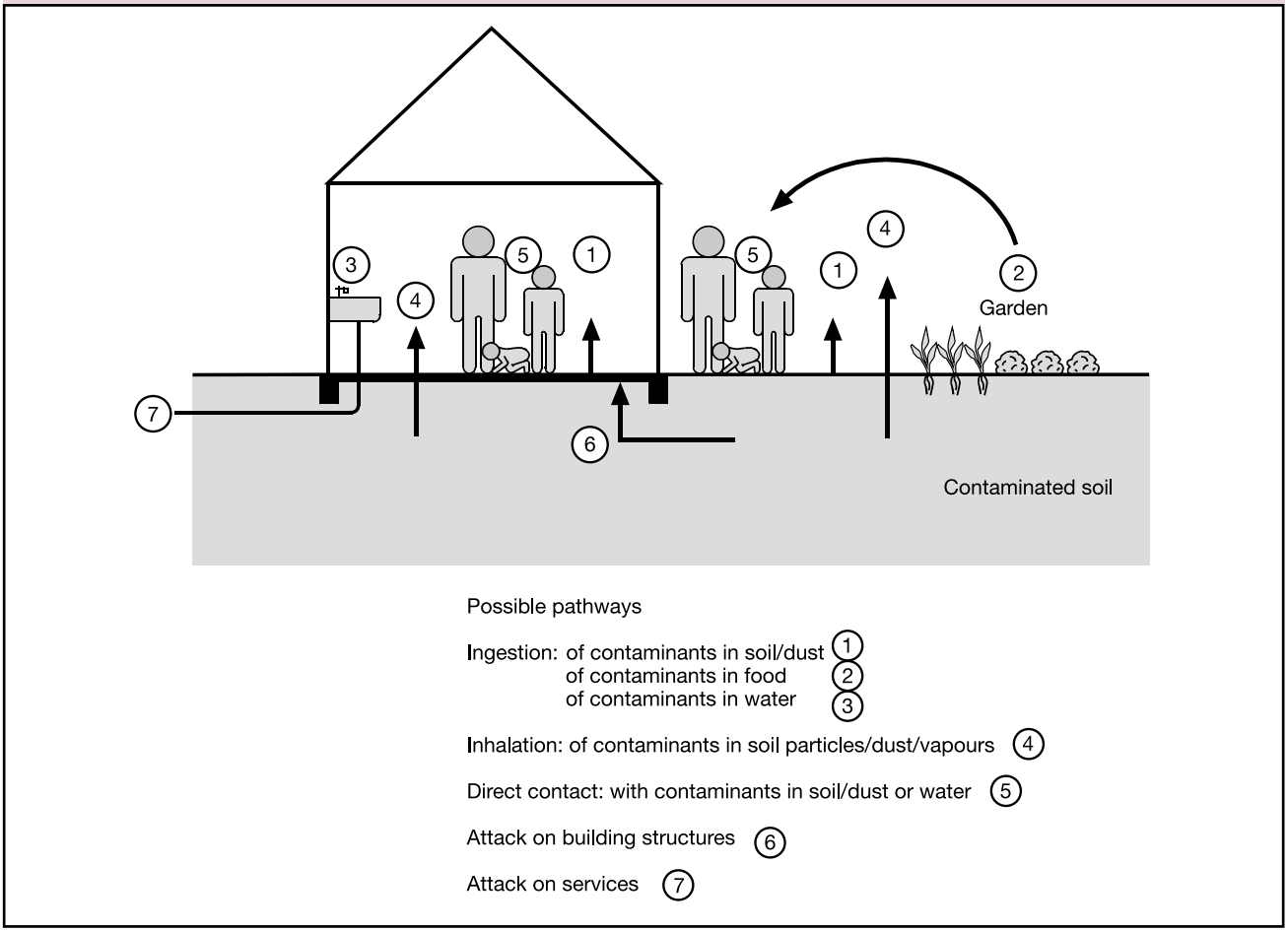
a. treating the contaminant (e.g. use of physical, chemical or biological processes to eliminate or reduce the contaminant's toxicity or harmful properties);

b. blocking or removing the pathway (e.g. isolating the contaminant beneath protective layers or installing barriers to prevent migration);

c. protecting or removing the receptor (e.g. changing the form or layout of the development, using appropriately designed building materials, etc.);

d. removing the contaminant (e.g. excavating contaminated material).

Diagram 1 **Example of a conceptual model for a site showing source–pathway–receptor**




**Stages of risk assessment**

**2.7** In assessing the risks for land contamination a tiered approach is adopted with an increasing level of detail required in progressing through the tiers. The three tiers are: preliminary risk assessment, generic quantitative risk assessment (GQRA) and detailed quantitative risk assessment (DQRA). Once the need for a risk assessment has been identified, it will always be necessary to undertake a preliminary risk assessment but, depending on the situation and the outcome, it may not be appropriate to do a more detailed risk assessment. Alternatively, it may be necessary to do only one or both of the more detailed risk assessments. For each tier, the model procedures for the management of land contamination (CLR 11, Consultation draft 2003) describes the stages of risk assessment that should be followed for identifying risks and making judgements about the consequences of land affected by contamination when developing a site. These are outlined below:

a. **Hazard identification – developing the conceptual model by establishing contaminant sources, pathways and receptors.** This is the preliminary site assessment which consists of a desk study and a site walk-over in order to obtain sufficient information to obtain an initial understanding of the potential risks. An initial conceptual model for the site can be based on this information.

b. **Hazard assessment – identifying what pollutant linkages may be present and analysing the potential for unacceptable risks.** Collect further information and undertake exploratory site investigation to refine understanding of risks and the likelihood of pollutant linkages. The results may be interpreted using generic criteria and assumptions.

c. **Risk estimation – establishing the scale of the possible consequences by considering the degree of harm that may result and to which receptors.** Undertake detailed ground investigation to collect sufficient data to estimate the risks the contaminants may pose to defined receptors under defined conditions of exposure.

d. **Risk evaluation – deciding whether the risks are acceptable or unacceptable.** Review all site data to decide whether estimated risks are unacceptable, taking into account the nature and scale of any uncertainties associated with the risk estimation process.

**2.8** Guidance on the investigation of sites potentially affected by contaminants is provided in:

a. *the Association of Geotechnical and Geoenvironmental Specialists (AGS) document*;*Guidelines for combined geoenvironmental and geotechnical investigations.*

b. *BS 5930:1999 Code of practice for site investigations*;

c. *BS 10175:2001 Investigation of potentially contaminated sites. Code of practice.***;** and

d. the Environment Agency documents;

*National Groundwater & Contaminated Land Centre report NC/99/38/2 Guide to good practice for the development of conceptual models and the selection and application of mathematical models of contaminant transport processes in the subsurface.*

*Defra/Environment Agency Contaminated Land Research ReportCL Assessment of risks to human health from land contamination: an overview of the development of soil guideline values and related research, 2002.*

*Defra/Environment Agency Contaminated Land Research Report CLR 8 Priority contaminants for the assessment of land, 2002.*

*Defra/Environment Agency Contaminated Land Research Report CLR 9 Contaminants in soil: collation of toxicological data and intake values for humans, 2002.*

*Defra/Environment Agency Contaminated Land Research Report CLR 10 The contaminated land exposure assessment model (CLEA): technical basis and algorithms, 2002.*

*Defra/Environment Agency Contaminated Land Research Report CLR 11 Handbook of model procedures for the management of contaminated land (in preparation).*

*Environment Agency R & D Technical Report P5-065 Technical aspects of site investigation, 2000.*

*Environment Agency R & D Technical Report P5-066 Secondary model procedure for the development of appropriate soil sampling strategies for land contamination.*

They recommend a risk based approach to identify and quantify the hazards that may be present and the nature of the risk they may pose. They describe the design and execution of field investigations, including suitable sample distribution strategies, sampling and testing.

**Hazard identification and assessment**

**2.9** A preliminary site assessment is required to provide information on the past and present uses of the site and surrounding area that may give rise to contamination (see Table 1). During the site walk-over there may be signs of possible contaminants (see Table 2). The information collated from the desk study and site walk-over can assist and will dictate the design of the exploratory and detailed ground investigation.

**2.10** The site assessment and risk evaluation should pay particular attention to the area of the site subject to building operations. Those parts of the land associated with the building that include the building itself, gardens and other places on the site that are accessible to users of the building and those in and about the building should be remediated to the requirements of the Building Regulations.

There may be a case for a lower level of remediation if part of, or the remainder of, the land associated with the building, or adjacent to such land, is accessible to a lesser extent to the user or those in and about the building than the main parts of the buildings and their respective

gardens. This incremental approach may also apply when very large sites are subject to redevelopment in stages; it may be possible to limit remediation to the site that is subject to building operations.

In all cases the risk evaluation and remediation strategy documentation is likely to be appropriate for demonstrating that restricted remediation is acceptable. The onus is on the applicant to show why part of a site may be excluded from particular remediation measures.

### Risk estimation and evaluation

**2.11** The detailed ground investigation must provide sufficient information for the confirmation of a conceptual model for the site, the risk assessment and the design and specification of any remedial works. This is likely to involve collection and analysis of soil, soil gas, surface and groundwater samples by the use of invasive and/or non-invasive techniques. An investigation of the groundwater regime, levels and flows is essential for most sites since elevated groundwater levels could bring contaminants close to the surface both beneath the building and in any land associated with the building. Expert advice should be sought but further guidance and information are provided in Annex A.

**2.12** During the development of land affected by contaminants the health and safety of both the public and workers should be considered. *HSE Report HSG 66 Protection of workers and the general public during the development of contaminated land, 1991.* and *CIRIA Report 132 A guide to safe working practices for contaminated land, 1993*

## Remedial measures

### Introduction

**2.13** If unacceptable risks to the defined receptor have been identified then these need to be managed through appropriate remedial measures. The risk management objectives are defined by the need to break the pollutant linkages using the methods outlined in paragraph 2.5 and described below. Other objectives will also need to be considered such as timescale, cost, remedial works, planning constraints and sustainability. Depending on the contaminant, three generic types of remedial measures can be considered: treatment, containment and removal. Management and transportation of contaminated waste will require a license from the office of Environmental Health and Pollution Regulation.

Table 2 **Examples of possible contaminant**

| Signs of possible contaminants | Possible contaminant |
|---|---|
| Vegetation (absence, poor or unnatural growth) | Metals<br>Metal compounds |
| | Organic compounds<br>Gases (landfill or natural source) |
| Surface materials (unusual colours and contours may indicate wastes and residues) | Metals<br>Metal compounds |
| | Oily and tarry wastes |
| | Asbestos |
| | Other mineral fibres |
| | Organic compounds including phenols |
| | Combustible material including coal and coke dust |
| | Refuse and waste |
| Fumes and odours (may indicate organic chemicals) | Volatile organic and/or sulphurous compounds from landfill or petrol/solvent spillage |
| | Corrosive liquids |
| | Faecal animal and vegetable matter (biologically active) |
| Damage to exposed foundations of existing buildings | Sulphates |
| Drums and containers (empty or full) | Various |

**Note**: the above list is not exhaustive

When building work is undertaken on sites affected by contaminants where control measures are already in place, care must be taken not to compromise these measures. For example, cover systems may be breached when new building foundations are constructed, such as when extensions are added.

### Treatment

**2.14** A wide range of treatment processes is now available for dealing with contaminants. Biological, chemical and physical techniques carried out either in or ex situ exist which may decrease one or more of the following features of the contaminants: mass, concentration, mobility, flux or toxicity. The choice of the most appropriate technique for a

particular site is a highly site-specific decision for which specialist advice should be sought.

**Containment**

**2.15** Containment in its widest sense usually means encapsulation of material containing contaminants but in the context of building development containment is often taken to mean cover systems. However, in-ground vertical barriers may also be required to control lateral migration of contaminants.

**2.16** Cover systems involve the placement of one or more layers of materials over the site to achieve one or more of the following objectives:

a. break the pollutant linkage between receptors and contaminants;

b. sustain vegetation;

c. improve geotechnical properties; and

d. reduce exposure to an acceptable level.

**2.17** Some of the building structures, e.g. foundations, sub-structure and ground floor, may, dependent on the circumstances and construction, contribute to measures to provide effective protection of health from contaminants.

**2.18** Imported fill and soil for cover systems should be assessed at source to ensure that it is not contaminated above specified concentrations and meets required standards for vegetation. *BS 3882:1994 Specification for topsoil.* Design and dimensioning of cover systems, particularly soil based ones typically used for gardens, should take account of their long-term performance where intermixing of the soil cover with the contaminants in the ground can take place. Maintenance and monitoring may be necessary. Gradual intermixing due to natural effects and activities such as burrowing animals, gardening, etc. needs to be considered. Excavations by householders for garden features, etc. can penetrate the cover layer and may lead to exposure to contaminants. Further guidance on the design, construction and performance of cover layers is given in the *Construction Industry Research and Information Association (CIRIA) Report SP124, Barriers, liners and cover systems for containment and control of land contamination, 1996.*

**Removal**

**2.19** This involves the excavation and safe disposal to licensed landfill of the contaminants and contaminated material. Excavation can be targeted to contaminant 'hot spots', or it may be necessary to remove sufficient depth of contaminated material to accommodate a cover system within the planned site levels. Removal may not be viable depending on the extent and depth of the contaminants on the site and the availability of suitably licensed landfills. Imported fill should be assessed at source to ensure that there are no materials that will pose unacceptable risks to potential receptors.

**2.20** Further detailed guidance on all three types of remedial measure is given in the *Environment Agency/NHBC R & D Publication 66 referred to above* and in a series of *CIRIA publications*.

*CIRIA Special Publication SP102 Decommissioning, decontamination and demolition, 1995.*

*CIRIA Special Publication SP104 Classification and selection of remedial methods, 1995.*

*CIRIA Special Publication SP105 Excavation and disposal, 1995.*

*CIRIA Special Publication SP106 Containment and hydraulic measures, 1996.*

*CIRIA Special Publication SP107 Ex-situ remedial methods for soils, sludges and sediments, 1995.*

*CIRIA Special Publication SP109 In-situ methods of remediation, 1995.*

## Risks to buildings, building materials and services

**2.21** The hazards to buildings, building materials and services on sites affected by contaminants need to be considered since these are also receptors. The hazards to consider are:

a. **Aggressive substances**. These include inorganic and organic acids, alkalis, organic solvents and inorganic chemicals such as sulphates and chlorides which may affect the long-term durability of construction materials (such as concrete, metals and plastics).

b. **Combustible fill.** This includes domestic waste, colliery spoil, coal, plastics, petrol-soaked ground, etc. which, if ignited, may lead to subterranean fires and consequent damage to the structural stability of buildings, and the integrity or performance of services.

c. **Expansive slags.** The two main types are blast furnace and steel making slag which may expand some time after deposition – usually when water is introduced onto the site – causing damage to buildings and services.

**d. Floodwater affected by contaminants.** Substances in the ground, waste matter or sewage may contaminate floodwater. This contaminated water may affect building elements, such as walls or ground floors, that are close to or in the ground. Guidance on resistant construction can be found in *Preparing for floods: interim guidance for improving the flood resistance of domestic and small business properties, ODPM, 2002. or BRE for Scottish Office Design guidance on flood damage for dwellings, TSO, 1996.*

**2.22** Although the building and building materials are the main receptors with these hazards, ultimately there could be harm to health. A particular concern is the effect of hydrocarbons permeating potable water pipes made of polyethylene. Guidance on reducing these risks is given in the *Foundation for Water Research Report FR0448 Laying potable water pipelines in contaminated ground: guidance notes, 1994*. Further guidance on the assessment and management of risks to building materials is given in a UK *Environment Agency document; Assessment and management of risks to buildings, building materials and services from land contamination, 2001*.

## Methane and other gases from the ground

### Introduction

**2.23** The term 'methane and other gases' is used to define hazardous soil gases which either originate from waste deposited in landfill sites or are generated naturally. It does not include radon which is dealt with separately in paragraphs 2.37 to 2.39. However, the term does include volatile organic compounds (VOCs). As stated in Limitations on Requirements above, measures described in this document are the minimum that are needed to comply with the Building Regulations. Further actions may be necessary to deal with the requirements of other legislation.

**2.24** Landfill gas is generated by the action of micro-organisms on biodegradable waste materials in landfill sites. It generally consists of methane and carbon dioxide together with small quantities of VOCs which give the gas its characteristic odour. Methane and oxygen deficient atmospheres (sometimes referred to as stythe or black-damp) containing elevated levels of carbon dioxide and nitrogen can be generated naturally in coal mining areas. Methane and carbon dioxide can also be produced by organic rich soils and sediments such as peat and river silts. A wide range of VOCs can also be present as a result of petrol, oil and solvent spillages. Methane and other gases can migrate through the subsoil and through cracks and fissures into buildings.

**2.25** Methane is an explosive and asphyxiating gas. Carbon dioxide although non-flammable is toxic. VOCs are not only flammable and toxic but can also have a strong, unpleasant odour. Should any of these gases build up to hazardous levels in buildings then they can cause harm to health or compromise safety.

### Risk assessment

**2.26** The risk assessment process outlined in paragraph 2.8 should also be adopted for methane and other gases. Further investigation for hazardous soil gases may be required where the ground to be covered by the building and/or any land associated with the building is:

a. On a landfill site, within 250m of the boundary of a landfill site or where there is suspicion that it is within the sphere of influence of such a site. The Environment Agency's policy on building development on or near to landfills should be followed.

b. On a site subject to the wide scale deposition of biodegradable substances (including made ground or fill).

c. On a site that has been subject to a use that could give rise to petrol, oil or solvent spillages.

d. In an area subject to naturally occurring methane, carbon dioxide and other hazardous gases (e.g. hydrogen sulphide).

**2.27** There are documents that cover hazardous soil gases in these specific contexts:

a. *HMIP Waste Management Paper No. 27 Landfill gas, 2nd edition, 1991.* gives guidance on the generation and movement of landfill gas as well as techniques for its investigation. Complementary guidance is given in a document by the *Chartered Institution of Wastes Management (CIWM) Monitoring of landfill gas, 2nd edition, 1998*.

b. The UK's *Institute of Petroleum TP 95 Guidelines for investigation and remediation of petroleum retail sites, 1998*.

c. *BGS Technical Report WP/95/1 Methane, carbon dioxide and oil seeps from natural sources and mining areas: characteristics, extent and relevance to planning and development in Great Britain, 1995,* gives guidance on the geographical extent of these contaminants, the associated hazards and methods of site investigation.

d. In addition, CIRIA has produced three relevant guidance documents on methane and other gases which describe how such gases are generated and move within the ground, methods of detection and monitoring and investigation strategies.

*CIRIA Report 130 Methane: its occurrence and hazards in construction, 1993.*

*CIRIA Report 131 The measurement of methane and other gases from the ground, 1993.*

*CIRIA Report 150 Methane investigation strategies, 1995.*

**2.28** During a site investigation for methane and other gases it is important to take measurements over a sufficiently long period of time in order to characterise gas emissions fully. This should also include periods when gas emissions are likely to be higher, e.g. during periods of falling atmospheric pressure. It is also important to establish not only the concentration of these gases in the ground but also the quantity of gas generating materials, their rate of gas generation, gas movement in the ground and gas emissions from the ground surface. This is an important part of the risk estimation stage. Indications about the gas regime in the ground can be obtained through surface emission rate and borehole flow rate measurements, and guidance on this is given in *CIRIA Report 151 Interpreting measurements of gas in the ground, 1995,* and *CIRIA Report 152 Risk assessment for methane and other gases from the ground, 1995.*

**2.29** Construction activities undertaken as part of building development can alter the gas regime on the site. For example, a site strip can increase surface gas emissions as can piling and excavation for foundations, and dynamic compaction can push dry biodegradable waste into moist, gas-active zones.

**2.30** There are no Soil Guideline Values (see Annex A) for methane and other gases. When assessing gas risks in the context of traditional housing there is a need to consider two pathways for human receptors: (i) gas entering the dwelling through the sub-structure, and building up to hazardous levels, and (ii) subsequent householder exposure in garden areas which can include where outbuildings (e.g. garden sheds and greenhouses) and extensions are constructed, and where there may also be excavations for garden features (e.g. ponds).

**2.31** Guidance on undertaking gas risk assessment is given in *CIRIA Report 152 Risk assessment for methane and other gases from the ground, 1995*, and the GaSIM model is also available for assessing gas emissions from landfill sites; *Environment Agency GasSIM – Landfill gas assessment tool.* There is further discussion of gas risk assessment in the *Defra/Environment Agency document CLR 11 ; Handbook of model procedures for the management of land contamination, 2004.*

**2.32** *CIRIA Report 149 Protecting development from methane, 1995.*and the UK *Department of the Environment, Transport and the Regions (DETR) Partners in Technology (PIT) report* describe a range of ground gas regimes (defined in terms of soil gas concentrations of methane and carbon dioxide as well as borehole flow rate measurements) which can be helpful in assessing gas risks.

**2.33** Depending on the proposed use, for non-domestic development the focus might be on the building only, but the general approach is the same.

## Remedial measures

**2.34** If the risks posed by the gas are unacceptable then these need to be managed through appropriate building remedial measures. Site-wide gas control measures may be required if the risks on any land associated with the building are deemed unacceptable. Such control measures include removal of the gas generating material or covering together with gas extraction systems. Further guidance is contained in *CIRIA Report 149*. Generally speaking, expert advice should be sought in these circumstances.

**2.35** Gas control measures for dwellings consist of a gas resistant barrier across the whole footprint (i.e. walls and floor) above an extraction (or ventilation) layer from which gases can be dispersed and vented to the atmosphere. They are normally passive, i.e. gas flow is driven by stack (temperature difference) and wind effects. Consideration should be given to the design and layout of buildings to maximise the driving forces of natural ventilation. Further guidance on this and detailed practical guidance on the construction of protective measures for housing is given in the *BRE/Environment Agency Report BR 414 Protective measures for housing on gas-contaminated land, 2001*. (In order to accommodate gas resistant membrane, for example as shown in BR414, the position and type of insulation may have to be adjusted). The *DETR/Arup Environmental PIT Research Report: Passive venting of soil gases beneath buildings, 1997,* compares the performance of a range of commonly used gas control measures and can be used as a guide to the design of such measures.

**2.36** Gas control measures for non-domestic buildings use the same principles as those used for housing, and the *DETR/Arup Environmental report* (above) can also be used as a guide to design. Expert advice should be sought as the floor area of such buildings can be large and it is important to ensure that gas is adequately dispersed from beneath the floor. The use of mechanical (as opposed to passive) systems and monitoring and alarm systems may be necessary. There is a need for continued maintenance and calibration of these systems, so they are more appropriate with non-domestic buildings (as opposed to dwellings) since there is usually scope for this. Again, expert advice should be sought. Special sub-floor ventilation systems are carefully designed to ensure adequate performance and should not be modified unless subjected to a specialist review of the design. Such ventilation systems, particularly those using powered ventilation, are unlikely to be appropriate for owner occupied properties as there is a risk of interference by users.

## Radon

**2.37** Radon is a naturally occurring radioactive colourless and odourless gas which is formed in small quantities by radioactive decay wherever uranium and radium are found. It can move through the subsoil and so into buildings. Exposure to high levels for long periods increases the risk of developing lung cancer. To reduce this risk all new buildings, extensions and conversions, whether residential or non-domestic, built in locations where there may be elevated radon emissions, may need to incorporate precautions against radon.

Guidance on protection from radon in the workplace can be found in *BRE report BR 293 Radon in the workplace* in addition some of the techniques used for installing a radon resistant membrane, described in *BR 211*, may be suitable for use in domestic sized buildings with heating and ventilation regimes similar to those used in dwellings. The guidance in *BR 211* can be used as the basis for radon protection of other building types but this should be done with caution. Information in 'Radon in the workplace' provides guidance for existing non-domestic buildings.

Further guidance on extensions can be found in *GBG 25 Buildings and radon*.

# Section 3 - Subsoil drainage

**3.1** The provisions which follow assume that the site of the building is not subject to general flooding (see paragraph C.8) or, if it is, that appropriate steps are being taken.

**3.2** Where the water table can rise to within 0.25m of the lowest floor of the building, or where surface water could enter or adversely affect the building, either the ground to be covered by the building should be drained by gravity, or other effective means of safeguarding the building should be taken.

**3.3** If an active subsoil drain is cut during excavation and if it passes under the building it should be:

a. re-laid in pipes with sealed joints and have access points outside the building; or

b. re-routed around the building; or

c. re-run to another outfall (see Diagram 2).

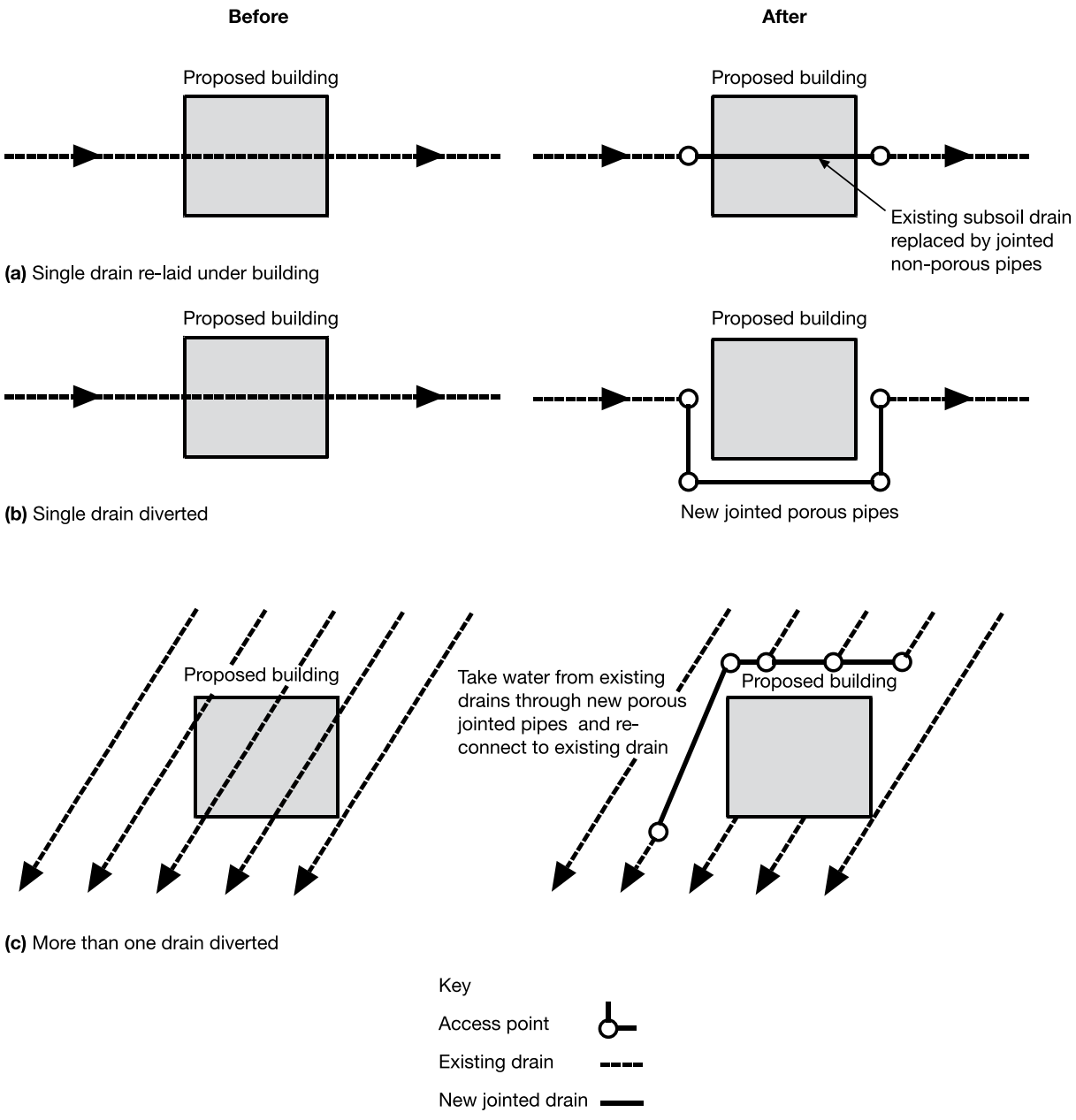
**3.4** Where there is a risk that groundwater beneath or around the building could adversely affect the stability and properties of the ground, consideration should be given to site drainage or other protection (see Section 4: Floors).

**3.5** For protecting low lying buildings or basements from localised flooding where foul water drainage also receives rainwater, refer to Guernsey Technical Standard H (Drainage and waste disposal). In heavy rainfall these systems surcharge and where preventative measures are not taken this could lead to increased risks of flooding within the property.

**3.6** Flooding can create blockages in drains and sewers that can lead to backflow of sewage into properties through low level drain gullies, toilets, etc. Guidance on anti-flooding devices is given in *CIRIA publication C506 Low cost options for the prevention of flooding from sewer, 1998*.

**3.7** General excavation work for foundations and services can alter groundwater flows through the site. Where contaminants are present in the ground, consideration should be given to subsoil drainage to prevent the transportation of water-borne contaminants to the foundations or into the building or its services.

## Diagram 2 **Subsoil drain cut during excavation**



# Section 4 - Floors

**4.1** This section gives guidance for five situations:

a. ground supported floors exposed to moisture from the ground (see paragraphs 4.6 to 4.12);

b. suspended timber ground floors exposed to moisture from the ground (see paragraphs 4.13 to 4.16);

c. suspended concrete ground floors exposed to moisture from the ground (see paragraphs 4.17 to 4.20);

d. the risk of interstitial condensation in ground floors and floors exposed from below (see paragraph 4.21);

e. the risk of surface condensation and mould growth on any type of floor (see paragraph 4.22).

**4.2** Floors next to the ground should:

a. resist the passage of ground moisture to the upper surface of the floor;

b. not be damaged by moisture from the ground;

c. not be damaged by groundwater;

d. resist the passage of ground gases. To meet requirement C1 (2) floors in some localities may need to resist the passage of hazardous ground gases such as radon or methane. Remedial measures will include a gas resistant barrier which, with proper detailing, can also function as a damp proof membrane. For specific guidance for methane and other gases refer to paragraphs 2.23 to 2.36, and for radon refer to paragraphs 2.37 to 2.39. Guidance is provided in reports *BR 414 Protective measures for housing on gas contaminated land, 2001 and BR 211 Radon: guidance on protective measures for new dwellings, 1999,* respectively.

**4.3** Consideration should be given to whether 4.2(a) need apply to a building used wholly for:

a. storing goods, provided that any persons who are habitually employed in the building are engaged only in taking in, caring for or taking out the goods; or

b. a purpose such that the provision would not serve to increase protection to the health or safety of any persons habitually employed in the building.

**4.4** Floors next to the ground and floors exposed from below should be designed and constructed so that their structural and thermal performance are not adversely affected by interstitial condensation.

**4.5** All floors should not promote surface condensation or mould growth, given reasonable occupancy conditions.

## Ground supported floors (Moisture from the ground)

**4.6** Any ground supported floor will meet the requirement if the ground is covered with dense concrete laid on a hardcore bed and a damp-proof membrane is provided. Suitable insulation may be incorporated.

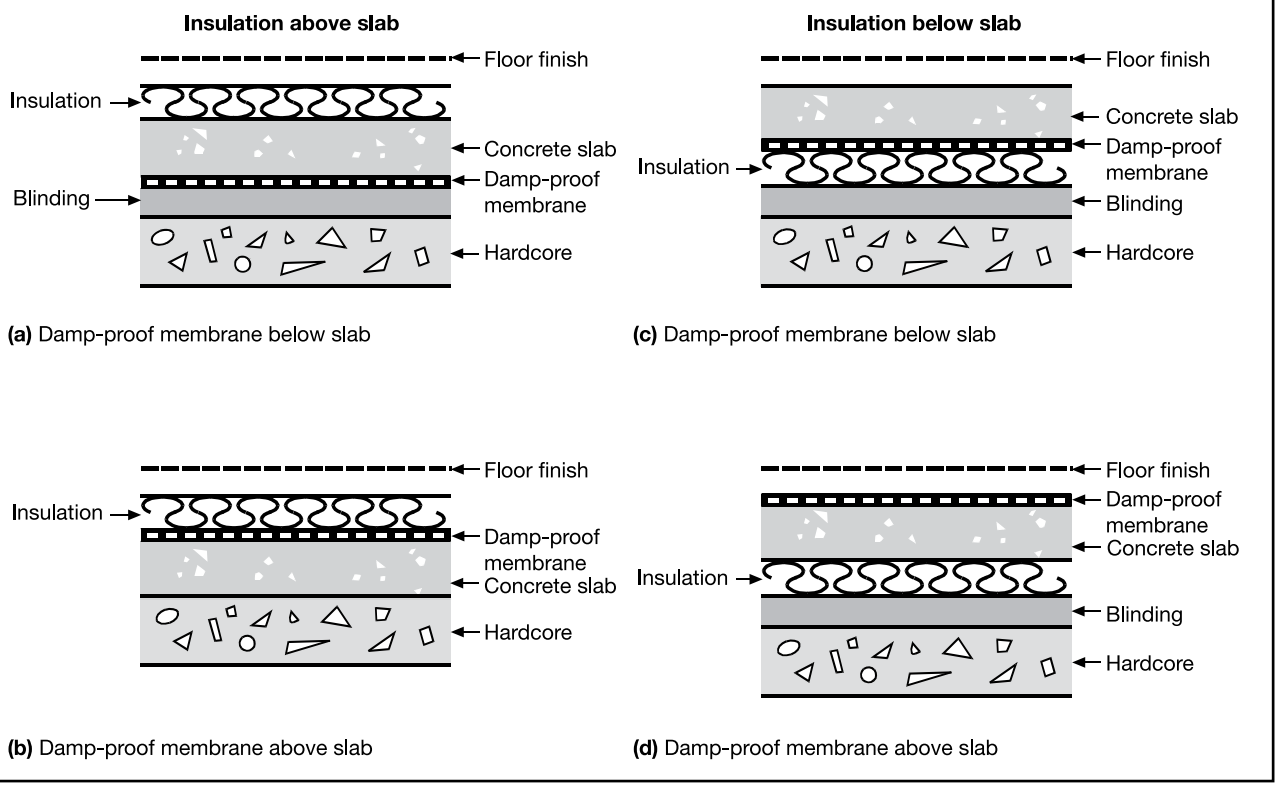
## Technical solution

**4.7** Unless it is subjected to water pressure, which is likely in the case of buildings on very permeable strata such as chalk, limestone or gravel (in which case see Alternative approach, paragraph 4.12), a concrete ground supported floor may be built as follows (Diagram 3):

a. well compacted hardcore bed, no greater than 600mm deep, of clean, broken brick or similar inert material, free from materials including water-soluble sulphates in quantities which could damage the concrete, *BRE Digest 276 Hardcore, 1992;* and

b. concrete at least 100mm thick (but thicker if the structural design requires) to mix ST2 in *BS 8500-1:2002 Concrete Complementary BS EN 206-1 Method of specifying and guidance for the specifier*, or, if there is embedded reinforcement, to mix ST4 in *BS 8500-1:2002 Concrete. Complementary BS EN 206-1 Method of specifying and guidance for the specifier;* and

Diagram 3 **Ground supported floor – construction (see paragraph 4.7)**




**(a)** Damp-proof membrane below slab

**(c)** Damp-proof membrane below slab

**(b)** Damp-proof membrane above slab

**(d)** Damp-proof membrane above slab

c. damp-proof membrane above or below the concrete, and continuous with the damp-proof courses in walls, piers and the like. If the ground could contain water soluble sulphates, or there is any risk that sulphate or other deleterious matter could contaminate the hardcore, the membrane should be placed at the base of the concrete slab.

**4.8** A membrane below the concrete could be formed with a sheet of polyethylene, which should be at least 300µm thick (1200 gauge) with sealed joints and laid on a bed of material that will not damage the sheet.

**4.9** A membrane laid above the concrete may be either polyethylene sheet as described above (but without the bedding material) or three coats of cold applied bitumen solution or similar moisture and water vapour resisting material. In each case it should be protected by either a screed or a floor finish, unless the membrane is pitchmastic or similar material which will also serve as a floor finish.

**4.10** Insulants placed beneath floor slabs should have sufficient strength to resist the weight of the slab and the anticipated floor loading as well as any possible overloading during construction. In order to resist degradation insulation that is placed below the damp proof membrane should have low water absorption. If necessary the insulant should be resistant to contaminants in the ground.

**4.11** A timber floor finish laid directly on concrete may be bedded in a material which may also serve as a damp-proof membrane. Timber fillets laid in the concrete as a fixing for a floor finish should be treated with an effective preservative unless they are above the damp-proof membrane. Some preservative treatments are described in *BS 1282:1999 Wood preservatives. Guidance on choice, use and application.*

## Alternative approach

**4.12** The requirement can also be achieved by following the relevant recommendations of *Clause 11 of BS CP 102:1973 Protection of buildings against water from the ground. BS 8102:1990 Code of practice for protection of structures against water from the ground*, includes recommendations for floors subject to water pressure.

## Suspended timber ground floors (moisture from the ground)

**4.13** Any suspended timber floor next to the ground will meet the requirement if:

a. the ground is covered so as to resist moisture and prevent plant growth; and

b. there is a ventilated air space between the ground covering and the timber; and

c. there are damp-proof courses between the timber and any material which can carry moisture from the ground.

## Technical solution

**4.14** Unless it is covered with a floor finish which is highly vapour resistant (in which case see the Alternative approach in paragraph 4.16), a suspended timber floor next to the ground may be built as follows (Diagram 4):

a. Ground covering either:

i. unreinforced concrete at least 100mm thick to mix ST 1 in *BS 8500-1:2002 Concrete. Complementary BS EN 206-1 Method of specifying and guidance for the specifier*. The concrete should be laid on a compacted hardcore bed of clean, broken brick or any other inert material free from materials including water-soluble sulphates in quantities which could damage the concrete; or

ii. concrete, composed as described above, or inert fine aggregate, in either case at least 50mm thick laid on at least 300µm (1200 gauge) polyethylene sheet with sealed joints, and itself laid on a bed of material which will not damage the sheet.

To prevent water collecting on the ground covering, either the top should be entirely above the highest level of the adjoining ground or, on sloping sites, consideration should be given to installing drainage on the outside of the up-slope side of the building (see Diagram 5).

b. Ventilated air space measuring at least 75mm from the ground covering to the underside of any wall-plates and at least 150mm to the underside of the suspended timber floor (or insulation if provided). Two opposing external walls should have ventilation openings placed so that the ventilating air will have a free path between opposite sides and to all parts. The openings should be not less than either 1,500mm$^2$/m run of external wall or 500mm$^2$/m$^2$ of floor area, whichever gives the greater opening area. Any pipes needed to carry ventilating air should have a diameter of at least 100mm. Ventilation openings should incorporate suitable grilles which prevent the entry of vermin to the sub-floor but do not resist the air flow unduly. If floor levels need to be nearer to the ground to provide level access sub-floor ventilation can be provided through offset (periscope) ventilators.

Diagram 4 **Suspended timber floor – construction (see paragraph 4.14(a) (i))**

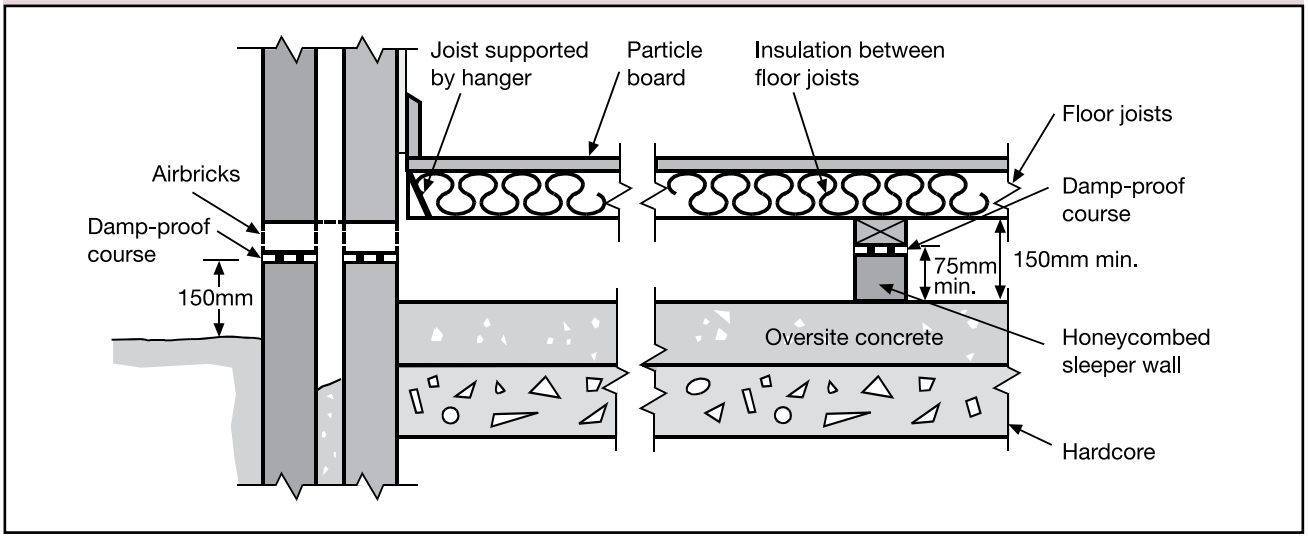
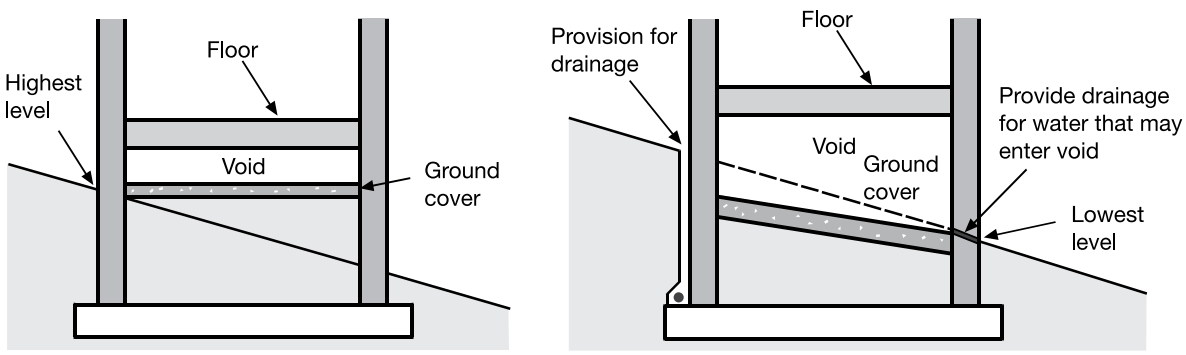


Diagram 5 **Suspended floor – preventing water collection (see paragraph 4.14(a))**




Note: Slope has been exaggerated for clarity

c. Damp-proof courses of impervious sheet material, engineering brick or slates in cement mortar or other material which will prevent the passage of moisture. Guidance for choice of materials is given in *BS 5628:Part 3:2001 Code of practice for use of masonry. Materials, components, design and workmanship*.

d. In shrinkable clay soils, the depth of the air space may need to be increased to allow for heave.

**4.15** In areas such as kitchens, utility rooms and bathrooms where water may be spilled, any board used as a flooring, irrespective of the storey, should be moisture resistant. In the case of chipboard it should be of one of the grades with improved moisture resistance specified in *BS 7331:1990 Specification for direct surfaced wood chipboard based on thermosetting resins.* or *BS EN 312 Part 5:1997 Particleboards,. Specifications. Requirements for load-bearing boards for use in humid conditions*. It should be laid, fixed and jointed in the manner recommended by the manufacturer. To demonstrate compliance the identification marks should be facing upwards. Any softwood boarding should be at least 20mm thick and from a durable species or treated with a suitable preservative.

## Alternative approach

**4.16** The requirement can also be met (see paragraph 4.14 above) by following the relevant recommendations of *Clause 11 of BS CP 102:1973 Protection of buildings against water from the ground.*

## Suspended concrete ground floors (moisture from the ground)

**4.17** Any suspended floor of in situ or precast concrete, including beam and block floors, next to the ground will meet the requirement if it will adequately prevent the passage of moisture to the upper surface and if the reinforcement is protected against moisture.

## Technical solution

**4.18** One solution for a suspended concrete floor could be:

a. in situ concrete at least 100mm thick (but thicker if the structural design requires) containing at least 300kg of cement for each $m^3$ of concrete; or

b. precast concrete construction with or without infilling slabs; and

c. reinforcing steel protected by concrete cover of at least 40mm if the concrete is in situ and at least the thickness required for a moderate exposure if the concrete is precast.

**4.19** A suspended concrete floor will meet the requirements if it incorporates:

a. a damp-proof membrane (if the ground below the floor has been excavated below the lowest level of the surrounding ground and will not be effectively drained); and

b. a ventilated air space. This should measure at least 150mm clear from the ground to the underside of the floor (or insulation if provided). Two opposing external walls should have ventilation openings placed so that the ventilating air will have a free path between opposite sides and to all parts of the floor void. The openings should be not less than either 1500mm$^2$/m run of external wall or 500mm$^2$/m$^2$ of floor area, whichever gives the greater opening area. Any pipes needed to carry ventilating air should have a diameter of at least 100mm. Ventilation openings should incorporate suitable grilles which prevent the entry of vermin to the sub-floor but do not resist the air flow unduly.

**4.20** On sites where flooding is likely, consideration may be given to including means of inspecting and clearing out the sub-floor voids beneath suspended floors. For guidance, see the *DTLR publication on preparing for floods: interim guidance for improving the flood resistance of domestic and small business properties, ODPM, 2002.*

## Ground floors and floors exposed from below (resistance to damage from interstitial condensation)

**4.21** A ground floor or floor exposed from below, i.e. above an open parking space or passageway, as shown in Diagram 6, will meet the requirement if it is designed and constructed in accordance with *Clause 8.5 and Appendix D of BS 5250:2002 Code of practice for the control of condensation in buildings, BS EN ISO 13788:2002 Hygrothermal performance of building components etc. and BR 262 Thermal insulation: avoiding risks, 2002.*

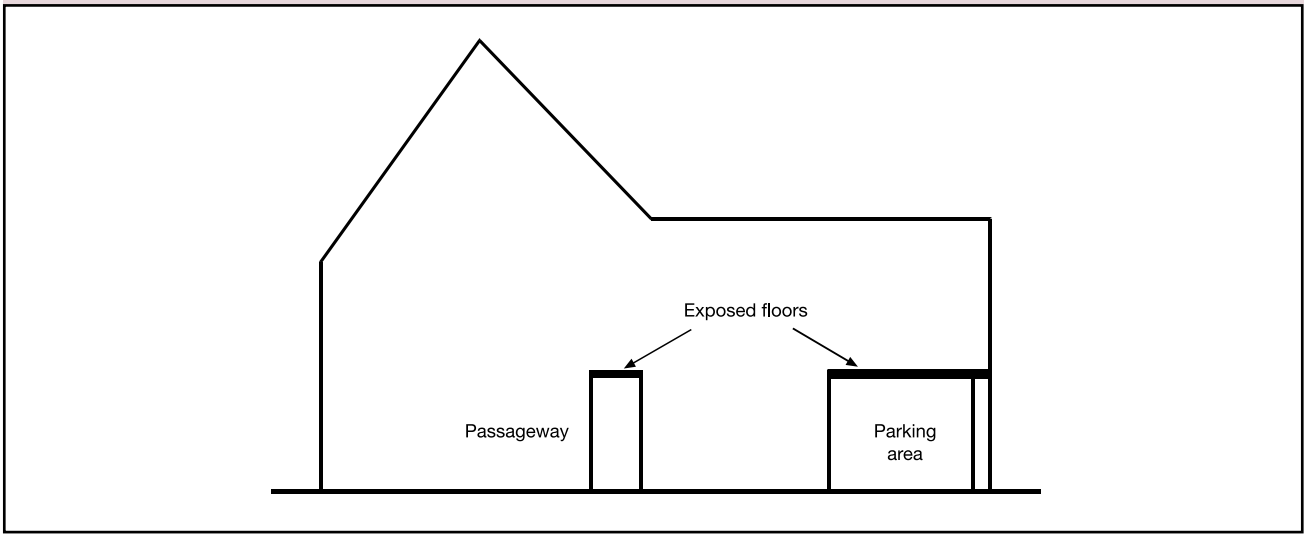
## Floors (Resistance to surface condensation and mould growth)

**4.22** A floor will meet the requirement if:

a. a ground floor is designed and constructed so that the thermal transmittance (U-value) does not exceed 0.7W/m$^2$K at any point; and

b. in the case of all floors, the junctions between elements are designed in accordance with the recommendations in the report *DTLR Limiting thermal bridging and air leakage etc, 2001*, or follow the guidance of *BRE IP17/01 Assessing the effects of thermal bridging at junctions and around openings, 2001.*

Diagram 6 **Typical floors exposed from below**



# Section 5 - Walls

**5.1** This section gives guidance for four situations:

a. internal and external walls exposed to moisture from the ground (see paragraphs 5.4 to 5.6);

b. external walls exposed to precipitation from the outside, covering:

   i. solid external walls (see paragraphs 5.8 to 5.11);

   ii. cavity external walls (see paragraphs 5.12 to 5.15);

   iii. framed external walls (see paragraph 5.17);

   iv. cracking of walls (see paragraph 5.18);

   v. impervious cladding systems (see paragraphs 5.19 to 5.28);

   vi. the joint between window and door frames and external walls and door thresholds (see paragraphs 5.29 to 5.33);

c. the risk of interstitial condensation in any type of wall (see paragraphs 5.34 to 5.35);

d. the risk of surface condensation or mould growth on any type of wall (see paragraph 5.36).

A wall includes piers, columns and parapets. It also includes chimneys if they are attached to the building. It does not include windows, doors and similar openings, but does include the joint between their frames and the wall. In the following, the term 'precipitation' includes the effects of spray blown from the sea or any other body of water adjacent to the building.

**5.2** Walls should:

a. resist the passage of moisture from the ground to the inside of the building; and

b. not be damaged by moisture from the ground and not carry moisture from the ground to any part which would be damaged by it, and, if the wall is an external wall:

c. resist the penetration of precipitation to components of the structure that might be damaged by moisture; and

d. resist the penetration of precipitation to the inside of the building; and

e. be designed and constructed so that their structural and thermal performance are not adversely affected by interstitial condensation; and

f. not promote surface condensation or mould growth, given reasonable occupancy conditions.

**5.3** Consideration should be given to whether provisions 5.2(a) and (d) need apply to a building used wholly for:

a. storing goods, provided that any persons who are habitually employed in the building are engaged only in taking in, caring for or taking out the goods; or

b. a purpose such that the provision would not serve to increase protection to the health or safety of any persons habitually employed in the building.

## Internal and external walls (moisture from the ground)

**5.4** Any internal or external wall will meet the requirement if a damp proof course is provided.

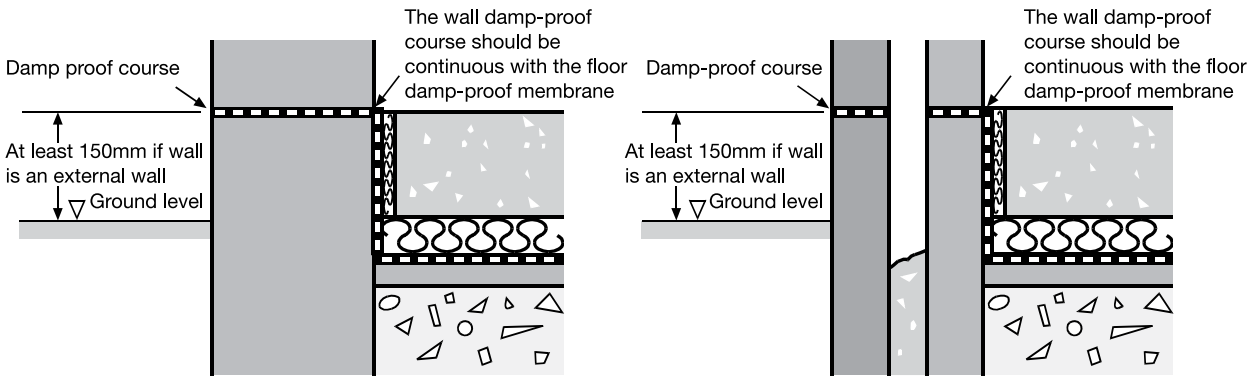
## Technical solution

**5.5** An internal or external wall will meet the requirement if it is built as follows (unless it is subject to groundwater pressure, in which case see the Alternative approach – paragraph 5.6):

a. damp-proof course of bituminous material, polyethylene, engineering bricks or slates in cement mortar or any other material that will prevent the passage of moisture. The damp proof course should be continuous with any damp-proof membrane in the floors; and

b. if the wall is an external wall, the damp-proof course should be at least 150mm above the level of the adjoining ground (see Diagram 7), unless the design is such that a part of the building will protect the wall; and

Diagram 7 **Damp proof courses (see paragraph 5.5(b))**




c. if the wall is an external cavity wall, (see Diagram 8a) the cavity should be taken down at least 225mm below the level of the lowest damp-proof course, or a damp-proof tray should be provided so as to prevent precipitation passing into the inner leaf (see Diagram 8b), with weep holes every 900mm to assist in the transfer of moisture through the external leaf. Where the damp-proof tray does not extend the full length of the exposed wall, i.e. above an opening, stop ends and at least two weep holes should be provided.

## Alternative approach

**5.6** The requirement can also be met by following the relevant recommendations of Clauses 4 and 5 of *BS 8215:1991 Code of practice for design and installation of damp-proof courses in masonry construction. BS 8102:1990 Code of practice for protection of structures against water from the ground,* includes recommendations for walls subject to groundwater pressure including basement walls.

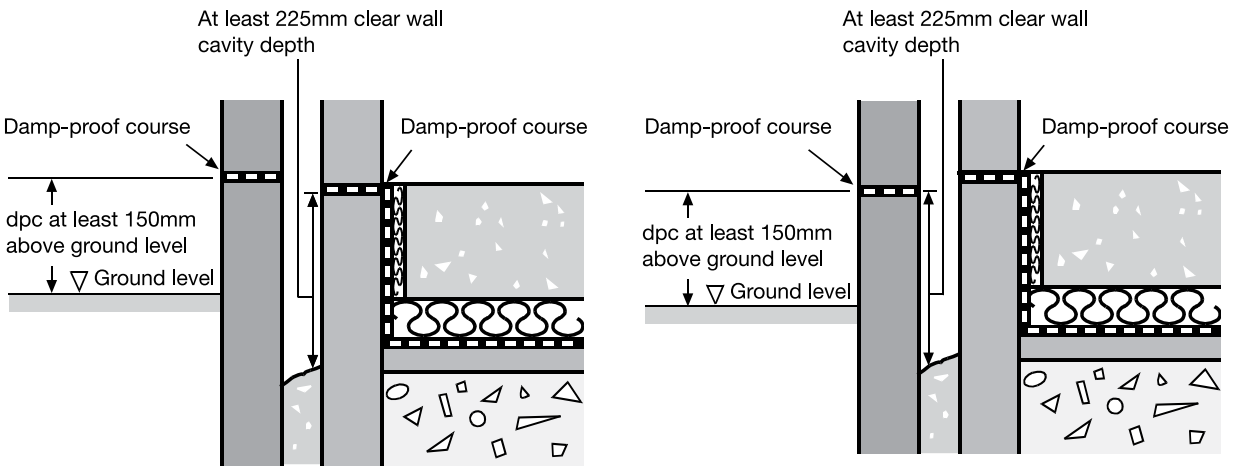
## External walls (moisture from the outside)

**5.7** As well as giving protection against moisture from the ground, an external wall should give protection against precipitation. This protection can be given by a solid wall of sufficient thickness (see paragraphs 5.8 to 5.11), or by a cavity wall (see paragraphs 5.12 to 5.18), or by an impervious or weather-resisting cladding (see paragraphs 5.19 to 5.28).

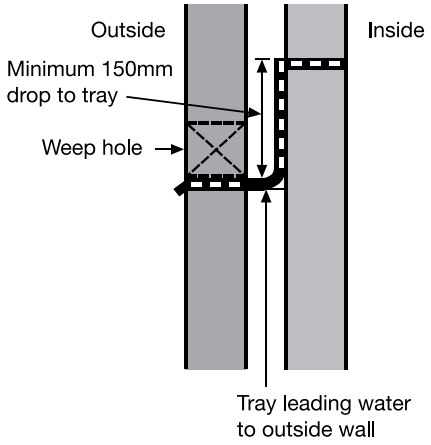
## Solid External Walls

**5.8** Any solid wall will meet the requirement if it will hold moisture arising from rain and snow until it can be released in a dry period without penetrating to the inside of the building, or causing damage to the building. The wall thickness will depend on the type of brick and block and on the severity of wind-driven rain. A method of describing the exposure to wind-driven rain is given in *BS 8104:1992 Code of practice for assessing exposure of walls to wind-driven rain*; see also *BS 5628-3:2001 Code of practice for use of masonry. Materials and components, design and workmanship.*

Diagram 8 **Protecting inner leaf (see paragraph 5.5(c))**




**(a)** Cavity carried down




**(b)** Damp proof (cavity) tray

## Technical solution

**5.9** A solid external wall in conditions of very severe exposure should be protected by external impervious cladding, but in conditions of severe exposure may be built as follows:

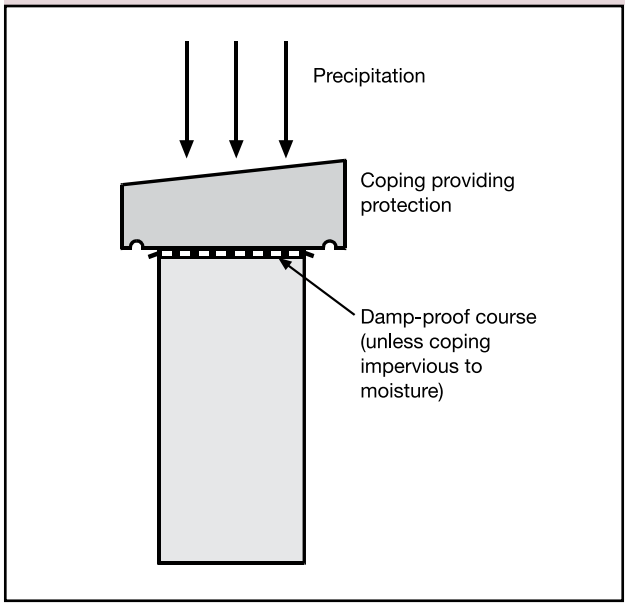
a. **brickwork or stonework** at least 328mm thick, dense aggregate concrete blockwork at least 250mm thick, or lightweight aggregate or aerated autoclaved concrete blockwork at least 215mm thick; and

b. **rendering:** the exposed face of the bricks or blocks should be rendered or be given no less protection. Rendering should be in two coats with a total thickness of at least 20mm and should have a scraped or textured finish. The strength of the mortar should be compatible with the strength of the bricks or blocks. The joints, if the wall is to be rendered, should be raked out to a depth of at least 10mm. Further guidance is given in *BS EN 998:2003 Specification for mortar for masonry*. The rendering mix should be one part of cement, one part of lime and six parts of well graded sharp sand (nominal mix 1:1:6) unless the blocks are of dense concrete aggregate, in which case the mix may be 1:0.5:4. *BS 5262:1991 Code of practice for external renderings,* includes recommendations for a wider range of mixes according to the severity of exposure and the type of brick or block.

Premixed and proprietary renders should be used in accordance with the manufacturer's instructions:

c. **protection** should be provided where the top of walls, etc. would otherwise be unprotected (see Diagram 9). Unless the protection and joints will be a complete barrier to moisture, a damp-proof course should also be provided;

Diagram 9 **Protection of wall head from precipitation (see paragraph 5.9(c))**




d. **damp-proof courses, cavity trays and closers** should be provided and designed to ensure that water drains outwards:

   i. where the downward flow will be interrupted by an obstruction, such as some types of lintel; and

   ii. under openings, unless there is a sill and the sill and its joints will form a complete barrier; and

   iii. at abutments between walls and roofs.

**5.10 Insulation**. A solid external wall may be insulated on the inside or on the outside. Where it is on the inside a cavity should be provided to give a break in the path for moisture and where it is on the outside it should provide some resistance to the ingress of moisture to ensure the wall remains relatively dry (see Diagram 10).

## Alternative approach

**5.11** The requirement can also be met by following the relevant recommendations of *BS 5628-3:2001 Code of practice for use of masonry. Materials, components, design and workmanship*. The code describes alternative constructions to suit the severity of the exposure and the type of brick or block.

## Cavity External Walls

**5.12** Any external cavity wall will meet the requirement if the outer leaf is separated from the inner leaf by a drained air space, or in any other way which will prevent precipitation from being carried to the inner leaf.

## Technical solution

**5.13** The construction of a cavity external wall could include:

a. outer leaf masonry (bricks, blocks, stone or manufactured stone); and

b. cavity at least 50mm wide. The cavity is to be bridged only by wall ties, cavity trays provided to prevent moisture being carried to the inner leaf (see paragraph 5.15 for cavity insulation), and cavity barriers, firestops and cavity closures, where appropriate; and

c. inner leaf masonry or frame with lining.

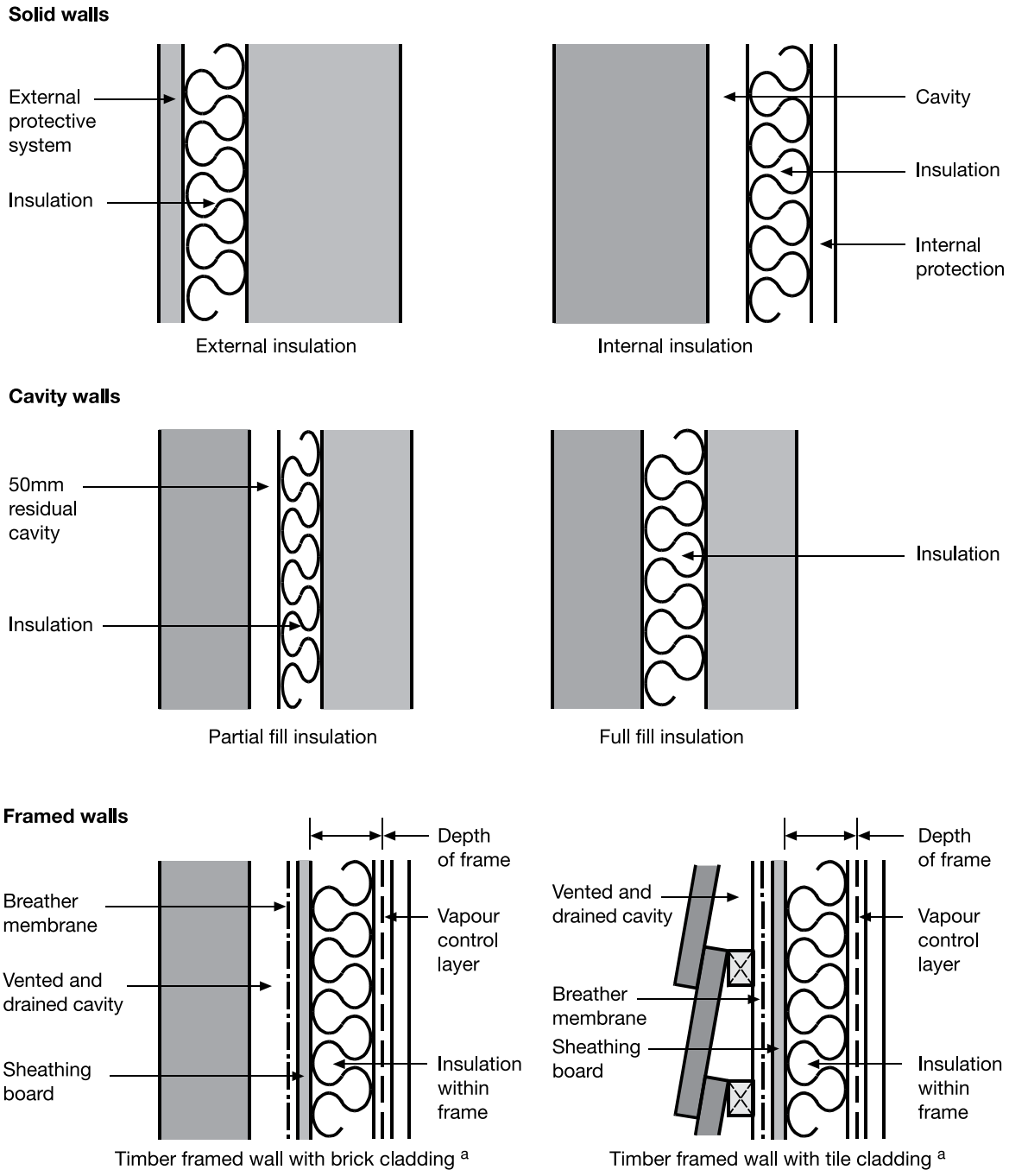
Masonry units should be laid on a full bed of mortar with the cross joints substantially and continuously filled to ensure structural robustness and weather resistance.

Where a cavity is to be partially filled, the residual cavity should not be less than 50mm wide (see Diagram 10).

## Alternative approach

**5.14** The requirement can also be met by following the relevant recommendations of *BS 5628-3:2001 Code of practice for use of masonry. Materials and components, design and workmanship*. The code describes factors affecting rain penetration of cavity walls.

Diagram 10 **Insulated external walls: examples (see paragraphs 5.10 and 5.13)**




Note: a) In the case of light steel frame the insulation inside the cavity is placed over the frame.

## Cavity Insulation

**5.15** A full or partial fill insulating material may be placed in the cavity between the outer leaf and an inner leaf of masonry subject to the following conditions:

a. The suitability of a wall for installing insulation into the cavity should be determined by reference to Table 3 or following the calculation or assessment procedure in current British or CEN standards. When partial fill materials are to be used, the residual cavity should not be less than 50mm nominal; and

b. A rigid (board or batt) thermal insulating material built into the wall should be the subject of current certification from an appropriate body or a European Technical Approval and the work should be carried out in accordance with the requirements of that document; or

c. Other insulating materials inserted into the cavity after the wall has been constructed should have certification from an appropriate body and be installed in accordance with the appropriate installations code. The suitability of the wall for filling is to be assessed before the work is carried out and the person undertaking the work should operate under an Approved Installer Scheme that includes an assessment of capability. Alternatively the insulating material should be the subject of current certification from an appropriate body or a European Technical Approval and the work should be carried out in accordance with the requirements of that document by operatives either directly employed by the holder of the document or employed by an installer approved to operate under the document; or

d. Urea-formaldehyde foam inserted into the cavity should be in accordance with *BS 5617:1985 Specification for urea-formaldehyde (UF) foam systems etc.,* and be installed in accordance with *BS 5618:1985 Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with UF foam systems.* The suitability of the wall for foam filling is to be assessed before the work is carried out and the person undertaking the work should operate under an Approved Installer Scheme that includes an assessment of capability.

e. When the cavity of an existing house is being filled, special attention should be given to the condition of the external leaf of the wall, e.g. its state of repair and type of pointing. Guidance is given in *BS 8208-1:1985 Guide to assessment of suitability of external cavity walls for filling with thermal insulation*. Some materials that are used to fill existing cavity walls may have a low risk of moisture being carried over to the internal leaf of the wall. In cases where a third party assessment of such a cavity fill material contains a method of assessing the construction of the walls and exposure risk, the procedure set out below may be replaced by that method.

Table 3 **Maximum recommended exposure zones for insulated masonry walls**

| Wall construction | | Maximum recommended exposure zone for each construction | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Insulation method | Min. width of filled or clear cavity (mm) | Impervious cladding | | Rendered finish | | Facing masonry | | |
| | | Full height of wall | Above facing masonry | Full height of wall | Above facing masonry | Tooled flush joints | Recessed mortar joints | Flush sills and copings |
| **Built-in full fill** | 50 | 4 | 3 | 3 | 3 | 2 | 1 | 1 |
| | 75 | 4 | 3 | 4 | 3 | 3 | 1 | 1 |
| | 100 | 4 | 4 | 4 | 3 | 3 | 1 | 2 |
| | 125 | 4 | 4 | 4 | 3 | 3 | 1 | 2 |
| | 150 | 4 | 4 | 4 | 4 | 4 | 1 | 2 |
| **Injected fill not UF foam** | 50 | 4 | 2 | 3 | 2 | 2 | 1 | 1 |
| | 75 | 4 | 3 | 4 | 3 | 3 | 1 | 1 |
| | 100 | 4 | 3 | 4 | 3 | 3 | 1 | 1 |
| | 125 | 4 | 4 | 4 | 3 | 3 | 1 | 2 |
| | 150 | 4 | 4 | 4 | 4 | 4 | 1 | 2 |
| **Injected fill UF foam** | 50 | 4 | 2 | 3 | 2 | 1 | 1 | 1 |
| | 75 | 4 | 2 | 3 | 2 | 2 | 1 | 1 |
| | 100 | 4 | 2 | 3 | 2 | 2 | 1 | 1 |
| **Partial fill** | | | | | | | | |
| Residual 50mm cavity | 50 | 4 | 4 | 4 | 4 | 3 | 1 | 1 |
| Residual 75mm cavity | 75 | 4 | 4 | 4 | 4 | 4 | 1 | 1 |
| Residual 100mm cavity | 100 | 4 | 4 | 4 | 4 | 4 | 2 | 1 |
| **Internal insulation** | | | | | | | | |
| Clear cavity 50mm | 50 | 4 | 3 | 4 | 3 | 3 | 1 | 1 |
| Clear cavity 100mm | 100 | 4 | 4 | 4 | 4 | 4 | 2 | 2 |
| Fully filled cavity 50mm | 50 | 4 | 3 | 3 | 3 | 2 | 1 | 1 |
| Fully filled cavity 100mm | 100 | 4 | 4 | 4 | 3 | 3 | 1 | 2 |

**5.16** For Guernsey an exposure of at least 3 is to be assumed. Where localised conditions accentuate wind effects, such as open hillsides or valleys where the wind is funnelled onto the wall, or on coastal locations add one to this exposure zone value;

(The national exposure zone value can be more accurately calculated from the larger scale maps and correction factors given in *BS 8104:1992 Code of practice for assessing exposure of walls to wind driven rain.*

Determine the recommended constructions from the modified exposure zone values given in Table 3. Further guidance as to the use of this table is given in *BRE Report BR 262 Thermal insulation: avoiding risks, 2002.*

## Framed external walls

**5.17** Any framed external wall will meet the requirement if the cladding is separated from the insulation or sheathing by a vented and drained cavity with a membrane that is vapour open, but resists the passage of liquid water, on the inside of the cavity (see Diagram 10).

## Cracking of external walls

**5.18** Severe rain penetration may occur through cracks in masonry external walls caused by thermal movement in hot weather or subsidence after prolonged droughts. The possibility of this should be taken into account when designing a building. Detailed guidance is given in:

a. *BRE Building Elements series: Walls, windows and doors, 2002*; and

b. *BRE Report BR 292 Cracking in buildings, 1995.*;

c. *BS 5628-3:2001 Code of practice for use of masonry. Materials and components, design and workmanship.*

## Impervious cladding systems for walls

**5.19** Cladding systems for walls should:

a. resist the penetration of precipitation to the inside of the building; and

b. not be damaged by precipitation and not carry precipitation to any part of the building which would be damaged by it.

**5.20** Cladding can be designed to protect a building from precipitation (often driven by the wind) either by holding it at the face of the building or by stopping it from penetrating beyond the back of the cladding.

**5.21** Any cladding will meet the requirement if:

a. it is jointless or has sealed joints, and is impervious to moisture (so that moisture will not enter the cladding); or

b. it has overlapping dry joints, is impervious or weather resisting, and is backed by a material which will direct precipitation which enters the cladding towards the outer face.

**5.22** Some materials can deteriorate rapidly without special care and they should only be used as the weather-resisting part of a cladding system if certain conditions are met (see Guernsey Technical Standard supporting Regulation 11, Materials and workmanship). The weather-resisting part of a cladding system does not include paint nor does it include any coating, surfacing or rendering which will not itself provide all the weather resistance.

## Technical solution

**5.23** Cladding may be:

a. impervious including metal, plastic, glass and bituminous products; or

b. weather resisting including natural stone or slate, cement based products, fired clay and wood; or

c. moisture resisting including bituminous and plastic products lapped at the joints, if used as a sheet material, and permeable to water vapour unless there is a ventilated space directly behind the material; or

d. jointless materials and sealed joints, which would allow for structural and thermal movement.

**5.24** Dry joints between cladding units should be designed so that precipitation will not pass through them, or the cladding should be designed so that precipitation which enters the joints will be directed towards the exposed face without it penetrating beyond the back of the cladding.

**Note:** Whether dry joints are suitable will depend on the design of the joint or the design of the cladding and the severity of the exposure to wind and rain.

**5.25** Each sheet, tile and section of cladding should be securely fixed. Guidance as to appropriate fixing methods is given in *BS 8000-6:1990 Workmanship on building sites. Code of practice for slating and tiling of roofs and claddings.* Particular care should be taken with detailing and workmanship at the junctions between cladding and window and door openings as they are vulnerable to moisture ingress.

**5.26** Insulation can be incorporated into the construction provided it is either protected from moisture or unaffected by it.

**5.27** Where cladding is supported by timber components or is on the façade of a timber framed building, the space between the cladding and the building should be ventilated to ensure rapid drying of any water that penetrates the cladding.

## Alternative approach

**5.28** The requirement can also be met by following the relevant recommendations of:

a. *BS CP 143 Code of practice for sheet roof and wall coverings.,* made from the following materials:

   Part 1:1958 Corrugated and troughed aluminium

   Part 5:1964 Zinc

   Part 10:1973 Galvanised corrugated steel

   Part 12:1970 (1988) Copper

   Part 15:1973 (1986) Aluminium

   Part 16:1974 Semi-rigid asbestos bitumen sheets

   Recommendations for lead are included in *BS 6915:2001 Design and construction of fully supported lead sheet roof and wall coverings. Code of practice*;

b. *BS 8219:2001 Installation of sheet roof and wall coverings. Profiled fibre cement. Code of practice*;

c. *BS 8200:1985 Code of practice for the design of nonloadbearing external vertical enclosures of buildings*;

d. *BS 8297:2000 Code of practice for design and installation of non-loadbearing precast concrete cladding*;

e. *BS 8298:1994 Code of practice for design and installation of natural stone cladding and lining*;

f. *MCRMA Technical Paper 6 Profiled metal roofing design guide, revised edition, 1996*;

g. *MCRMA Technical Paper 9 Composite roof and wall cladding panel design guide, 1995*.

These documents describe the materials and contain design considerations including recommendations for fixing.

## Joint between doors and windows

**5.29** The joint between walls and door and window frames should:

a. resist the penetration of precipitation to the inside of the building; and

b. not be damaged by precipitation and not permit precipitation to reach any part of the building which would be damaged by it.

**5.30** Damp-proof courses should be provided to direct moisture towards the outside:

a. where the downward flow of moisture would be interrupted at an obstruction, e.g. at a lintel;

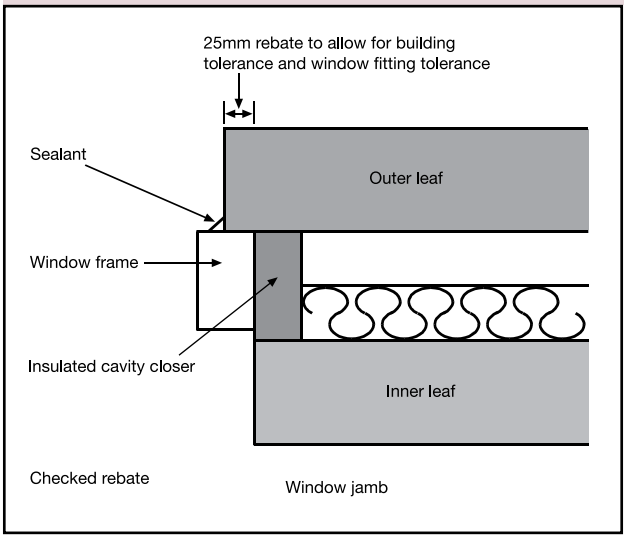
b. where sill elements, including joints, do not form a complete barrier to the transfer of precipitation, e.g. under openings, windows and doors;

c. where reveal elements, including joints, do not form a complete barrier to the transfer of rain and snow, e.g. at openings, windows and doors.

**5.31** In some cases the width of the cavity due to thermal insulation and the 50mm clearance for drainage may be such that the window frame is not wide enough to completely cover the cavity closer. The reveal may need to be lined with plasterboard, dry lining, a support system or a thermal backing board. Direct plastering of the internal reveal should only be used with a backing of expanded metal lathing or similar.

**5.32** In areas of the country in driving rain exposure zone 4 checked rebates should be used in all window and door reveals. The frame should be set back behind the outer leaf of masonry, which should overlap it as shown in Diagram 11. Alternatively an insulated finned cavity closer may be used.

Diagram 11 **Window reveals for use in areas of severe or very severe exposure to driving rain (see paragraph 5.32)**




## Door Thresholds

**5.33** Where an accessible threshold is provided to allow unimpeded access, as specified in Part M, Access to and use of buildings, it will meet the requirement if:

a. the external landing (Diagram 12) is laid to a fall between 1 in 40 and 1 in 60 in a single direction away from the doorway;

b. the sill leading up to the door threshold has a maximum slope of 15°.

Further advice for the development of accessible thresholds is given in *BRE GBG 47 Level external thresholds: reducing moisture penetration and thermal bridging, 2001.* and the *Accessible thresholds in new buildings: guidance for house builders and designers, TSO, 1999.*

## External Walls (Resistance to damage from interstitial condensation)

**5.34** An external wall will meet the requirement if it is designed and constructed in accordance with Clause 8.3 of *BS 5250:2002 Code of practice for the control of condensation in buildings.* and *BS EN ISO 13788:2001 Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods*.

**5.35** Because of the high internal temperatures and humidities, there is a particular risk of interstitial condensation in the walls of swimming pools and other buildings in which high levels of moisture are generated; specialist advice should be sought when these are being designed.

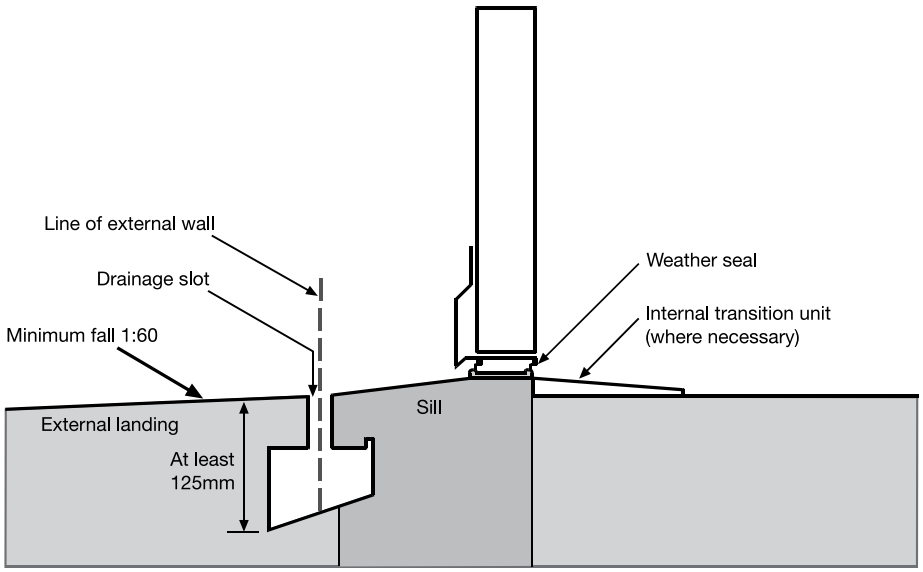
## External walls (resistance to surface condensation and mould growth)

**5.36** An external wall will meet the requirement if:

a. it is designed and constructed so that the thermal transmittance (U-value) does not exceed 0.7W/m$^2$K at any point; and

b. the junctions between elements and details of openings, such as doors and windows, are designed in accordance with the recommendations in the report on robust construction details *Limiting thermal bridging and air leakage: robust construction details for dwellings and similar buildings, TSO, 2001*, or follow the guidance of *BRE Information Paper IP17/01 Assessing the effects of thermal bridging at junctions and around openings, 2001.*

Diagram 12 **Accessible threshold for use in exposed areas (see paragraph 5.33)**



# Section 6 - Roofs

**6.1** This section gives guidance for three situations:

a. roofs exposed to precipitation from the outside (see paragraphs 6.3 to 6.9);

b. the risk of interstitial condensation in roofs (see paragraphs 6.10 to 6.13);

c. the risk of condensation or mould growth on the internal surface of roofs (see paragraph 6.14).

**6.2** Roofs should:

a. resist the penetration of precipitation to the inside of the building; and

b. not be damaged by precipitation and not carry precipitation to any part of the building which would be damaged by it;

c. be designed and constructed so that their structural and thermal performance are not adversely affected by interstitial condensation.

## Roofs (resistance to moisture from the outside)

**6.3** Roofing can be designed to protect a building from precipitation either by holding the precipitation at the face of the roof or by stopping it from penetrating beyond the back of the roofing system.

**6.4** Any roof will meet the requirement if:

a. it is jointless or has sealed joints, and is impervious to moisture (so that moisture will not enter the roofing system); or

b. it has overlapping dry joints, is impervious or weather resisting, and is backed by a material which will direct precipitation which enters the roof towards the outer face (as with roofing felt).

**6.5** Some materials can deteriorate rapidly without special care and they should only be used as the weather-resisting part of a roof if certain conditions are met (see Guernsey Technical Standard supporting Regulation 11, Materials and workmanship). The weather-resisting part of a roofing system does not include paint nor does it include any coating, surfacing or rendering which will not itself provide all the weather resistance.

## Technical solution

**6.6** Roofing systems may be:

a. impervious including metal, plastic and bituminous products; or

b. weather resisting including natural stone or slate, cement based products, fired clay and wood; or

c. moisture resisting including bituminous and plastic products lapped at the joints, if used as a sheet material, and permeable to water vapour unless there is a ventilated space directly behind the material; or

d. jointless materials and sealed joints, which would allow for structural and thermal movement.

**6.7** Dry joints between roofing sheets should be designed so that precipitation will not pass through them, or the system should be designed so that precipitation which enters the joints will be drained away without penetrating beyond the back of the roofing system.

**Note:** Whether dry joints are suitable will depend on the design of the joint or the design of the roofing system and the severity of the exposure to wind and rain.

**6.8** Each sheet, tile and section of roof should be fixed in an appropriate manner. Guidance as to appropriate fixing methods is given in *BS 8000-6:1990 Workmanship on building sites. Code of practice for slating and tiling of roofs and claddings.*

## Alternative approach

**6.9** The requirement can also be met by following the relevant recommendations of:

a. *BS CP 143 Code of practice for sheet roof and wall coverings.* made from the following materials:

   Part 1:1958 Corrugated and troughed aluminium

   Part 5:1964 Zinc

   Part 10:1973 Galvanized corrugated steel

   Part 12:1970 (1988) Copper

   Part 15:1973 (1986) Aluminium

   Part 16:1974 Semi-rigid asbestos bitumen sheets.

   Recommendations for lead are included in *BS 6915:2001 Design and construction of fully supported lead sheet roof and wall coverings. Code of practice*;

b. *BS 8219:2001 Installation of sheet roof and wall coverings. Profiled fibre cement. Code of practice*;

c. *BS 8200:1985 Code of practice for the design of nonloadbearing external vertical enclosures of buildings*;

d. *MCRMA Technical Paper 6 Profiled metal roofing design guide, revised edition, 1996*;

e. *MCRMA Technical Paper 9 Composite roof and wall cladding panel design guide, 1995*.

These documents describe the materials and contain design considerations including recommendations for fixing.

## Roofs (resistance to damage from interstitial condensation)

**6.10** A roof will meet the requirement if it is designed and constructed in accordance with Clause 8.4 of *BS 5250:2002 Code of practice for the control of condensation in buildings,* and *BS EN ISO 13788:2002 Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods.* Further guidance is given in the *BRE Report BR 262 Thermal insulation: avoiding risks, 2002*.

**6.11** The requirement will be met by the ventilation of cold deck roofs, i.e. those roofs where the moisture from the building can permeate the insulation. For the purposes of health and safety it may not always be necessary to provide ventilation to small roofs such as those over porches and bay windows. Although a part of a roof which has a pitch of 70° or more is to be insulated as though it were a wall, the provisions in this document apply to roofs of any pitch.

**6.12** To avoid excessive moisture transfer to roof voids gaps and penetrations for pipes and electrical wiring should be filled and sealed; this is particularly important in areas of high humidity, e.g. bathrooms and kitchens. An effective draught seal should be provided to loft hatches to reduce inflow of warm air and moisture.

**6.13** Because of the high internal temperatures and humidities, there is a particular risk of interstitial condensation in the roofs of swimming pools and other buildings in which high levels of moisture are generated; specialist advice should be sought when these are being designed.

## Roofs (resistance to surface condensation and mould growth)

**6.14** A roof will meet the requirement if:

a. it is designed and constructed so that the thermal transmittance (U-value) does not exceed 0.35W/m$^2$K at any point; and

b. the junctions between elements and the details of openings, such as windows, are designed in accordance with the recommendations in the report on robust construction details, *Limiting thermal bridging and air leakage: robust construction details for dwellings and similar buildings, DTLR, 2001.*, or follow the guidance of *BRE Information Paper IP17/01 Assessing the effects of thermal bridging at junctions and around openings, 2001,* or *MCRMA Technical Paper 14 Guidance for the design of metal roofing and cladding to comply with approved document L2:2001, 2002.* for profiled metal roofing.

# Annex A - Guidance on the assessment of land affected by contaminants

**A.1** A substantial amount of guidance on the assessment of contaminated land has been published. Most of this guidance is contained in the joint Defra/Environment Agency Contaminated Land Research Reports (CLRs). This guidance can be used to support the assessment process set out in Section 2. A summary of the reports is set out below and an outline of the process is given in Figure A1

**A.2** For health, risk estimation can be carried out using generic assessment criteria such as contaminant soil guideline values (SGVs) or relevant and appropriate environmental standards. SGVs represent contaminant concentrations which may pose unacceptable risks to health. The development of SGVs for a range of priority contaminants is described in the Defra/ Environment Agency reports CLR 7, CLR 8, CLR 9 and CLR 10.

**A.3** CLR 10 describes the Contaminated Land Exposure Assessment Model (CLEA) for deriving SGVs for three different site uses: (i) residential, (ii) residential with plant uptake and (iii) commercial/ industrial. In this way the relative importance of each of the pollutant linkages is considered. For example, for residential site use it is assumed residents have private gardens and/ or access to community open space close to the home and that some may use their gardens to grow vegetables. CLR 10 gives details of the conceptual model underpinning each of the standard land uses.

**A.4** A series of Defra/Environment Agency SGV reports contain SGVs for a range of contaminants, one report for each contaminant, and the corresponding TOX reports contain the toxicological data used to derive the SGVs. SGVs should be used only in conjunction with the CLR 7 to 10 reports and associated SGV and TOX reports.

**A.5** The use of ICRCL (Interdepartmental Committee on the Redevelopment of Contaminated Land) document Guidance Note 59/83: Guidance on the assessment and redevelopment of contaminated land is no longer appropriate in health risk assessment and has been withdrawn by Defra.

**A.6** CLR 7 provides advice regarding such issues. In certain cases the most appropriate action may be to redesign the building layout. Further guidance can be obtained from the Environment Agency/ NHBC R & D Publication 66.

**A.7** An alternative to the generic approach is to undertake a more site-specific quantitative risk assessment using the principles of risk assessment or a risk assessment model. Specialist advice should be sought.

## References to Annex A

### UK Department for the Environment, Food and Rural Affairs (DEFRA)

Contaminated land Advice Note CLAN 3/02 Note on the withdrawal of ICRCL trigger value, 2002.

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R and D Publication 66 Guidance for the safe development of housing on land affected by contamination, 2000.

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### Inter-Departmental Committee on the Redevelopment of Contaminated Land (ICRCL)

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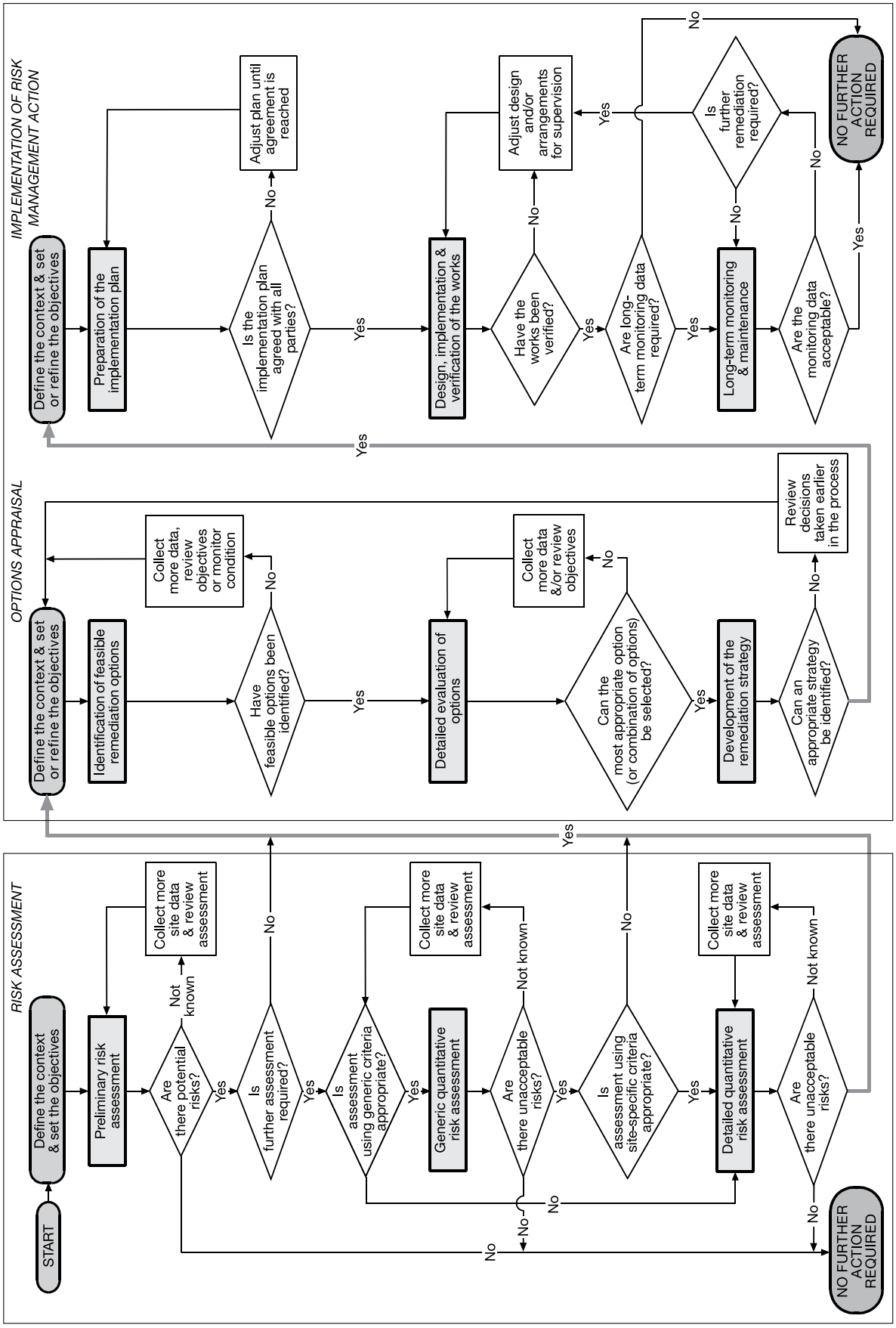
# GUIDANCE ON THE ASSESSMENT OF LAND AFFECTED BY CONTAMINANTS

## Diagram A1 **The process of managing land affected by contaminants**




Note: The process may apply to one or more pollutant linkages each of which may follow a different route.
For some linkages, it may be possible to stop at an early stage – others will progress all the way through the process.
The level of complexity of each stage may also vary and in some cases may be very simple.

# Annex B - Key Terms

**Building and land associated with the building.** The building and all the land forming the site subject to building operations which includes land under the building and the land around it which may have an effect on the building or its users (see also paragraph 2.10).

**Contaminant.** Any substance that is or may become harmful to persons or buildings, including substances which are corrosive, explosive, flammable, radioactive or toxic.

**Floor.** Lower horizontal surface of any space in a building including finishes that are laid as part of the permanent construction.

**Groundwater.** Water in liquid form, either as a static water table or flowing through the ground.

**Interstitial condensation.** Deposition of liquid water from a vapour, occurring within or between the layers of the building envelope.

**Moisture.** Water in liquid, solid or gaseous form.

**Precipitation.** Moisture in any form falling from the atmosphere, usually as rain, sleet, snow or hail.

**Roof.** Any part of the external envelope of a building that is at an angle of less than 70° to the horizontal.

**Spray.** Water droplets driven by the wind from the surface of the sea or other bodies of water adjacent to buildings. Sea spray can be especially hazardous to materials because of its salt content.

**Surface condensation.** Deposition of liquid water from a vapour, occurring on visible surfaces within the building.

**Vapour control layer.** Material of construction, usually a membrane, that substantially reduces the water vapour transfer through any building in which it is incorporated.

**Wall.** Any opaque part of the external envelope of a building that is at an angle of 70° or more to the horizontal.

# Annex C - Standards referred to and other documents

**BS EN 312-5:1997**
Particleboards. Specifications. Requirements for load-bearing boards for use in humid conditions. (Withdrawn and superseded by BS EN 312:2003 Particle boards. Specifications.)

**BS EN 998-2:2003**
Specification for mortar for masonry. Masonry mortar.

**BS 1282:1999**
Wood preservatives. Guidance on choice, use and application.

**BS EN ISO 3788:2002**
Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods. AMD 13792 2002.

**BS 3882:1994**

Specification for topsoil. AMD 9938 1998.

**BS 5250:2002**
Code of practice for the control of condensation in buildings.

**BS 5262:1991**
Code of practice for external renderings.

**BS 5617:1985**
Specification for ureaformaldehyde (UF) foam systems suitable for thermal insulation of cavity walls with masonry or concrete inner and outer leaves.

**BS 5618:198**

Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems. AMD 6262 1990, AMD 7114 1992.

**BS 5628-3:2001**

Code of practice for use of masonry. Materials and components, design and workmanship.

**BS 5930:1999**
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**BS 6915:2001**
Design and construction of fully supported lead sheet roof and wall coverings. Code of practice.

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Workmanship on building sites. Code of practice for slating and tiling of roofs and claddings.

**BS 8102:1990**

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Structural design of low-rise buildings. Code of practice for stability, site investigation, foundations and ground floor slabs for housing. AMD 8980 1995.

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**BS 8215:1991**
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Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier. AMD 14639 2003.

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**CP 102:1973**

Code of practice for protection of buildings against water from the ground. AMD 1551 1974, AMD 2196 1977, AMD 2470 1978.

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**CP 143-5:1964**
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**CP 143-10:1973**
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Available to download from www.odpm.gov.uk.

**Society for the Protection of Ancient Buildings (SPAB)**

Information Sheet 4 The need for old buildings to 'breathe', 1986.

Available from The Society for the Protection of Ancient Buildings, 37 Spital Square, London, E1 6DY. Website: www.spab.org.uk. Tel: 020 7377 1644. Email: info@spab.org.uk.

**Scottish Office (SO)**

Design guidance on flood damage to dwellings, 1996. ISBN 0 11495 776 2

**The Stationery Office (TSO)**

Accessible thresholds in new buildings. Guidance for house builders and designers, 1999. ISBN 0 11702 333 7

## GUERNSEY TECHNICAL STANDARDS

The following documents have been approved and issued by the Development and Planning Authority for the purpose of providing practical guidance with respect to the requirements of the Building Regulations

**Guernsey Technical Standard A**: Structure, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard B:** Fire Safety - Volume 1 - Dwellinghouses, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard B:** Fire Safety - Volume 2 - Buildings other than dwellinghouses, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard C:** Site preparation and resistance to contaminants and moisture 2012 edition with May 2016 amendments.

**Guernsey Technical Standard D**: Toxic substances 2012 edition with May 2016 amendments.

**Guernsey Technical Standard E**: Resistance to the passage of sound, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard F**: Ventilation, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard G**: Health, hygiene and water efficiency, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard H**: Drainage and waste disposal, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard J**: Heat producing appliances and fuel storage systems, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard K**: Safe means of access and egress, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard L1**: Conservation of fuel and power – Dwellings, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard L2**: Conservation of fuel and power – Buildings other than dwellings, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard M**: Access to and use of buildings, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard N**: Glazing - Materials and protection, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard P**: Roads - Layout design and construction, 2012 edition with May 2016 amendments.

**Guernsey Technical Standard Regulation 11**: Materials and Workmanship, 2012 edition with May 2016 amendments.

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