

# Radon risk in the development process

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## Content

Radon basics

UK radon protection

Awareness

Assessing radon potential and the need to test

Reducing risk – prevention, reduction, RPA intervention

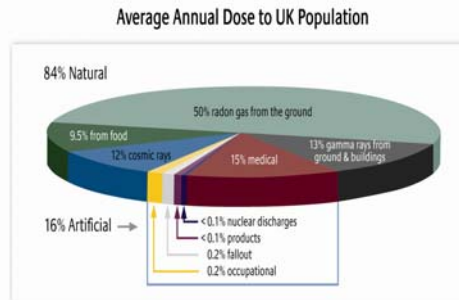
Reassurance for buyers and occupiers

## Radon basics - Why the concern

A radioactive gas – second largest cause of lung cancer and the biggest source of radiation for most people.

Keep things in perspective.

Health risks from radon are associated with long term exposure to high levels. Most people live and work in low risk areas. In high risk areas homes and workplaces can be tested and radon levels reduced if necessary.



## Radon basics - Geology

**A Natural Process:**

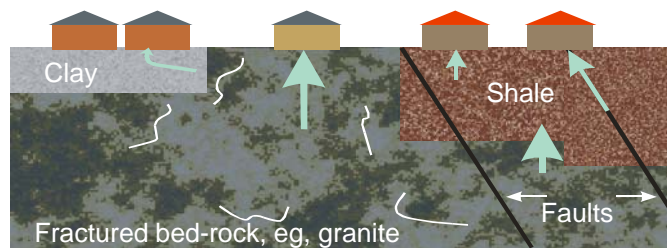
Uranium in rocks and soils

↓  
Radium in rocks and soils

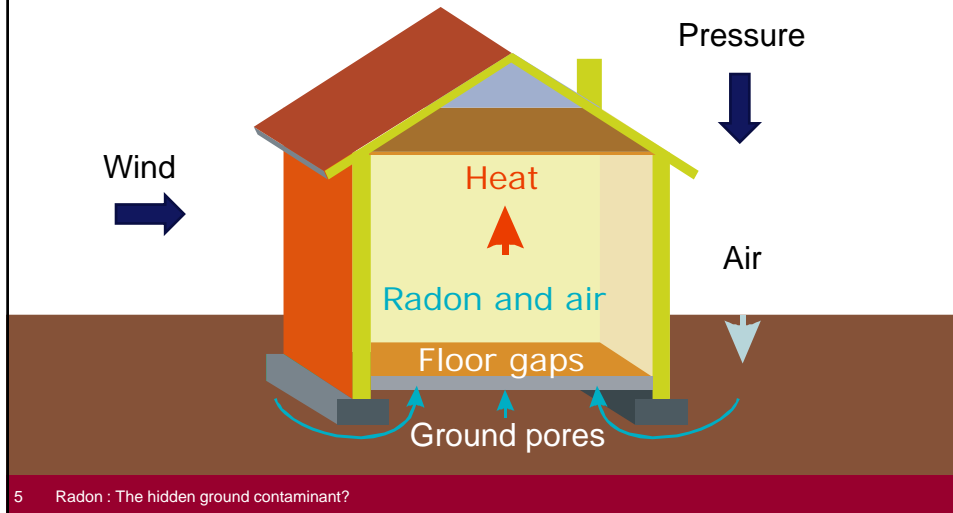
↓  
Radon in soil gas

**Geological process:**

- faulting of rock
- permeability
- movement of gas
- nature of overburden



## Radon basics - How radon enters buildings



## UK radon protection – Main regulations

Construction of new buildings, extensions and conversions

Approved Document C of schedule 1 of the Building Regulations – basic or full preventative measures

Limiting risk to occupiers

Housing Act 2004 – action defined by the Housing Health and Safety Rating System (HHSRS)

Health & Safety at Work Act 1974

Management of Health & Safety at Work Regulations 1999

Ionising Radiations Regulations 1999 (IRR99)

## UK radon protection – Main PHE advice

Construction of new buildings, extensions and conversions  
(Recommendations for inclusion in Building Regulations)

- At least basic protection in all
- Those requiring full protection to have an appropriate radon test in the first year of occupancy

Limiting risk to occupiers

- Test all homes in radon Affected Areas
- Test frequently occupied basements everywhere
- Domestic Action Level of 200 Bq m<sup>-3</sup> and Target Level of 100 Bq m<sup>-3</sup>
- Apply the domestic Action Level to high public occupancy workplaces

[Limitation of Human Exposure to Radon: RCE-15, Health Protection Agency 2010]

## UK radon protection – Overview

Building Control Regulations apply to any type of applicant. The requirement to test and take action on high levels depends on the sector.

Sector	Private domestic	Domestic landlord	Workplace
Control	Voluntary	Statutory	Statutory
Responsibility	Householder	Landlord	Employer
Action Level	200 Bq m <sup>-3</sup> (annual average)	200 Bq m <sup>-3</sup> (annual average)	400 Bq m <sup>-3</sup> (maximum)



## Awareness of radon: Sources

### Property transactions and development:

Local Authority (Form CON29), Building Control  
Solicitors (Form TA6)  
Environmental search companies & consultants  
Surveyors (independent and in-house)  
Insurance companies (NHBC etc)

*NB - Development >3% areas only*

### If not buying or developing?

PHE national Surveys  
Local publicity (with/without input from the LA)  
Health & Safety Inspectors  
Others, including acquisitions (imported knowledge), health concerns



## Assessing Radon Potential

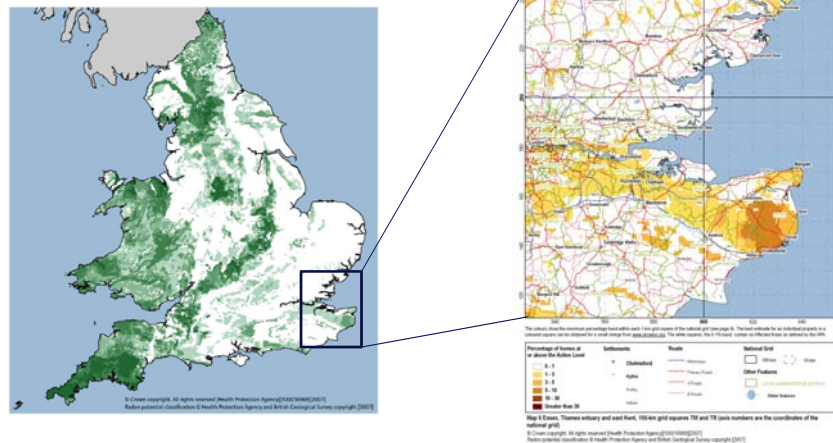
Measure the radon level in the ground? **X** (Not in the UK)

UK mapping uses test results from homes to assess the radon potential of underlying geology.

- Geological units with their determined radon potential are mapped and buffers added to allow for boundary uncertainties.
- 25 metre 'Tiled' data is produced to publish as a data set for searches and to form the basis of the indicative map

## Indicative Radon Atlas

Overall map of radon Affected Areas in England and Wales (from HPA-RPD-033)



## Assess the need to test

### INDICATIVE SEARCHES (England Wales & Scotland)

These use compiled data and show the worst case radon potential for the selection.

**Indicative Maps:** These show the worst level of radon potential for every 1 kilometre square (free download).

**Postcode based searches:** These show the worst level of radon potential from all the 25 metre squares covered by properties sharing the postcode.



## Assess the need to test

### DEFINITIVE SEARCHES (England Wales & Scotland)

These use the full radon data set of 25 metre x 25 metre squares.

For small buildings (footprints up to 25 metres in any direction) select the square based on the address on-line at [www.UKradon.org](http://www.UKradon.org) or use the BGS i-phone application.

For large sites, BGS can overlay building footprints. Some local authorities and environmental search companies have licensed use of the dataset.

**(Northern Ireland currently has a definitive map)**



## Assess the need to test

Search outcomes are based on the radon potential band

Radon potential band (%)	General risk	Affected Area?	Test advised?	Building Control Regulations?		
				England & Wales	Scotland	Northern Ireland
0 - 1	Low	No	No#	No#	No#	No#
1 - 3	Medium	Yes	Yes	No#	Yes-Stage 1	Yes-Zone 1
3 - 5		Yes	Yes	Yes-Basic	Yes-Stage 1	Yes-Zone 1
5 - 10		Yes	Yes	Yes-Basic	Yes-Stage 1	Yes-Zone 1
10 - 30	High	Yes	Yes	Yes-Full	Yes-Stage 2	Yes-Zone 2
Over 30		Yes	Yes	Yes-Full	Yes-Stage 2	Yes-Zone 2

# Testing existing buildings and fitting radon prevention in new buildings might still be considered, particularly if there is a high risk location such as a routinely occupied basement



## Reducing Risk : Prevention

No radon preventative measures are required:

In <1% areas in Scotland & NI  
In <3% areas England & Wales

Basic measures are required:

In 1-10% areas in Scotland & NI  
In 3-10% areas in England & Wales

Full measures are required:

In all 10% or more areas

Existing tests results do not negate the need to comply

Radon potential band (%)	General risk	Affected Area?	Test advised ?	Building Control Regulations?		
				England & Wales	Scotland	Northern Ireland
0 - 1	Low	No	No#	No#	No#	No#
1 - 3	Medium	Yes	Yes	No#	Yes-Stage 1	Yes-Zone 1
3 - 10	High	Yes	Yes	Yes-Basic	Yes-Stage 1	Yes-Zone 1
>10	High	Yes	Yes	Yes-Full	Yes-Stage 2	Yes-Zone 2

# Testing existing buildings and fitting radon prevention in new buildings might still be considered, particularly if there is a high risk location such as a routinely occupied basement

**Basic measures:** 300 micrometre (1200 gauge) polythene, cavity tray and full sealing of all joints and around service penetrations

**Full measures:** As above plus a radon sump or ventilated sub-floor void to which active air handling can be added retrospectively if needed



## Measurements

A validated test in a home is with two passive monitors (main living area and main bedroom), while the home is occupied normally and for a period of three months.

[www.ukradon.org/information/measuringradon](http://www.ukradon.org/information/measuringradon)

Also see:

[www.ukradon.org/information/workplace](http://www.ukradon.org/information/workplace)  
(work out how many monitors and where to place)

[www.ukradon.org/information/largepropertyportfolios](http://www.ukradon.org/information/largepropertyportfolios)  
(consideration of logistics and potential pitfalls)

Be aware that alterations to a building or its use can affect radon levels and repeat tests may be needed following any major changes.





## Reducing Risk : Reduction

Principle :

Prevent entry from the ground or dilute

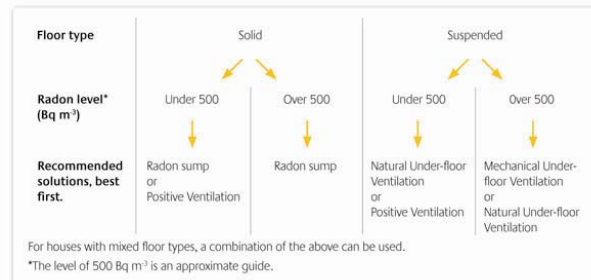
Method and Application:

Above floor

By room ventilation  
- natural or forced

Below floor

If solid by sump extraction  
If suspended by increased ventilation



Post remedy  
retest!

See [www.ukradon.org/information/reducelevels](http://www.ukradon.org/information/reducelevels) & [www.BRE.co.uk](http://www.BRE.co.uk)

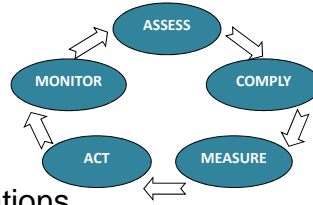
## Reducing Risk : Protection

**Domestic** – HHSRS is a risk based system interpreted and enforced by the Local Authority. In practice it remains largely voluntary as to whether or not reduction work is undertaken but landlords will generally be expected to comply.

**Workplaces** - IRR99 is enforced by the Health & Safety Executive. Once the 400 Bq m<sup>-3</sup> threshold for radon is exceeded, action must be taken to limit exposure. If the radon levels are reduced so the maximum level is below the threshold, IRR99 no longer applies.

If radon levels are not reduced promptly and the area remains in regular use, assessments of effective radiation dose will need to be made for each member of staff. IRR99 formally requires consultation with a suitable qualified Radiation Protection Advisor.

## Basic Process



ASSESS the risk of high radon levels

COMPLY with Building Control Regulations

MEASURE the premises in Affected Areas

ACT on any high results

MONITOR reduction systems & other changes

**IT IS IMPORTANT FOR MEMBERS OF PROFESSIONAL BODIES TO GUIDE CLIENTS THROUGH THIS PROCESS**

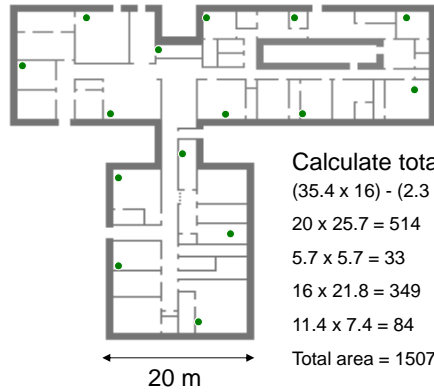
## How many monitors?

Ground floor and frequently occupied basements

<u>Workplace type</u>	<u>Such as</u>	<u>Number of monitors</u>
Office, individual/small rooms	Banks, shops, professionals	One per 100 m <sup>2</sup>
Open plan, retail, workshop	Admin/call centres, light industry, hotels	One per 250 m <sup>2</sup>
As above, up to 5000 m <sup>2</sup>	Large retail, etc	One per 500 m <sup>2</sup>
Very large areas	Manufacturing, warehouses	One for each area 1 per 1000 m <sup>2</sup> or so

For special underground areas such as mines, caves, water industry – test each main area (seek specialist advice)

## How many monitors & where?



Calculate total area  
 $(35.4 \times 16) - (2.3 \times 17) = 527$   
 $20 \times 25.7 = 514$   
 $5.7 \times 5.7 = 33$   
 $16 \times 21.8 = 349$   
 $11.4 \times 7.4 = 84$   
Total area = 1507 m<sup>2</sup>

Number of monitors = total area/100  $\cong 15$

## For how long?

Ideally test over a period of three months

