Radon in the workplace

Prospective survey 2019

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Outline

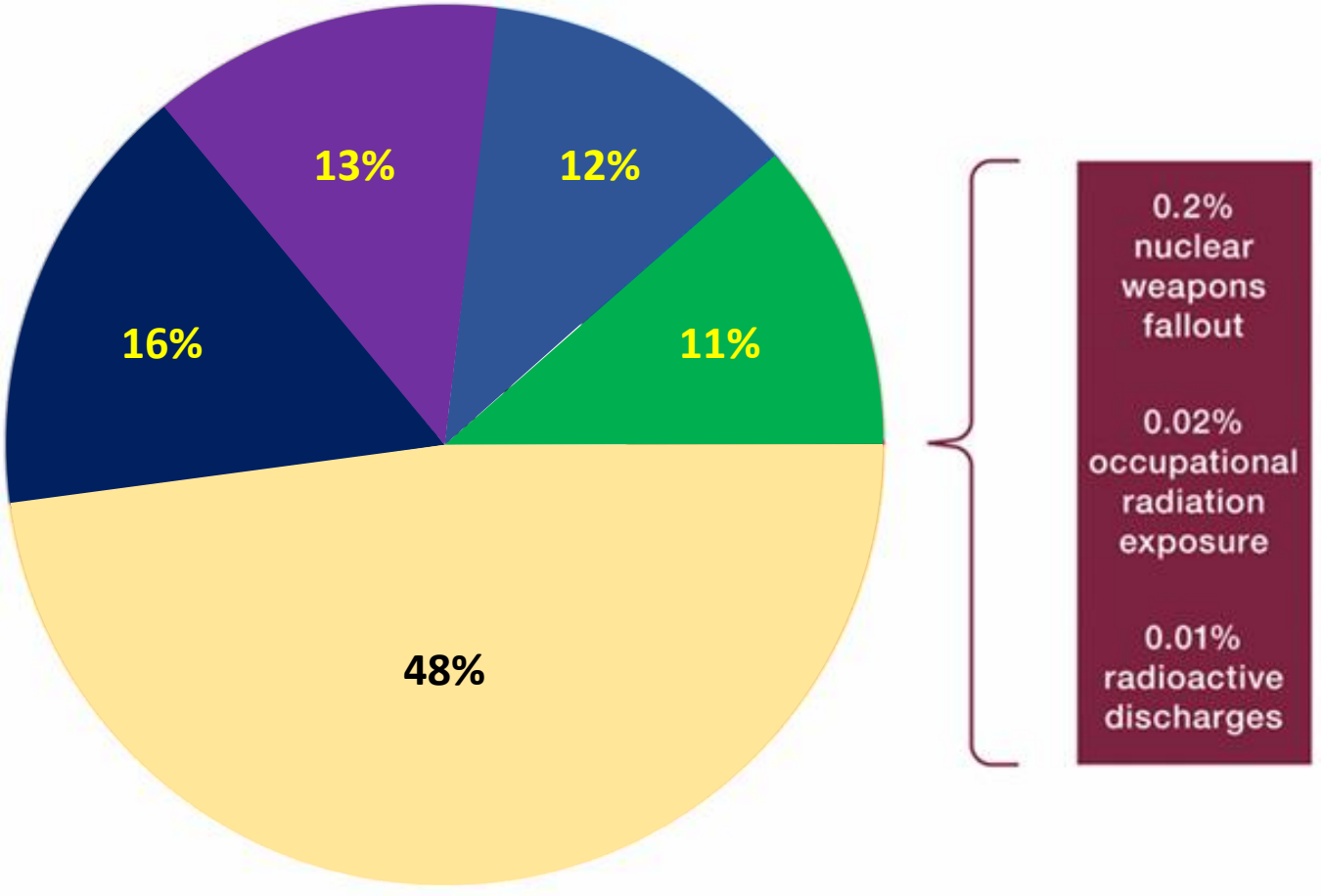
- What is radon?
- Why is it a problem?
- What can be done about it?

Natural and artificial sources of Radon-222

- Derived from uranium in the ground and building materials
- 20 Bq/m3 annual average
- Part of a decay chain, parent isotope: radium-226
- Radium-painted dials
- 3.8 days half-life, alpha decay, daughter products are solid and also alpha emitters
- **Accumulates** in below-ground areas (basements, caves, mines)

238U -----> 226Ra-> 222Rn -> 218Po -> 214Pb ---> 210Pb --> 210Po -> 206Pb

Contributions to annual radiation dose in the UK



UKradon - UK maps of radon

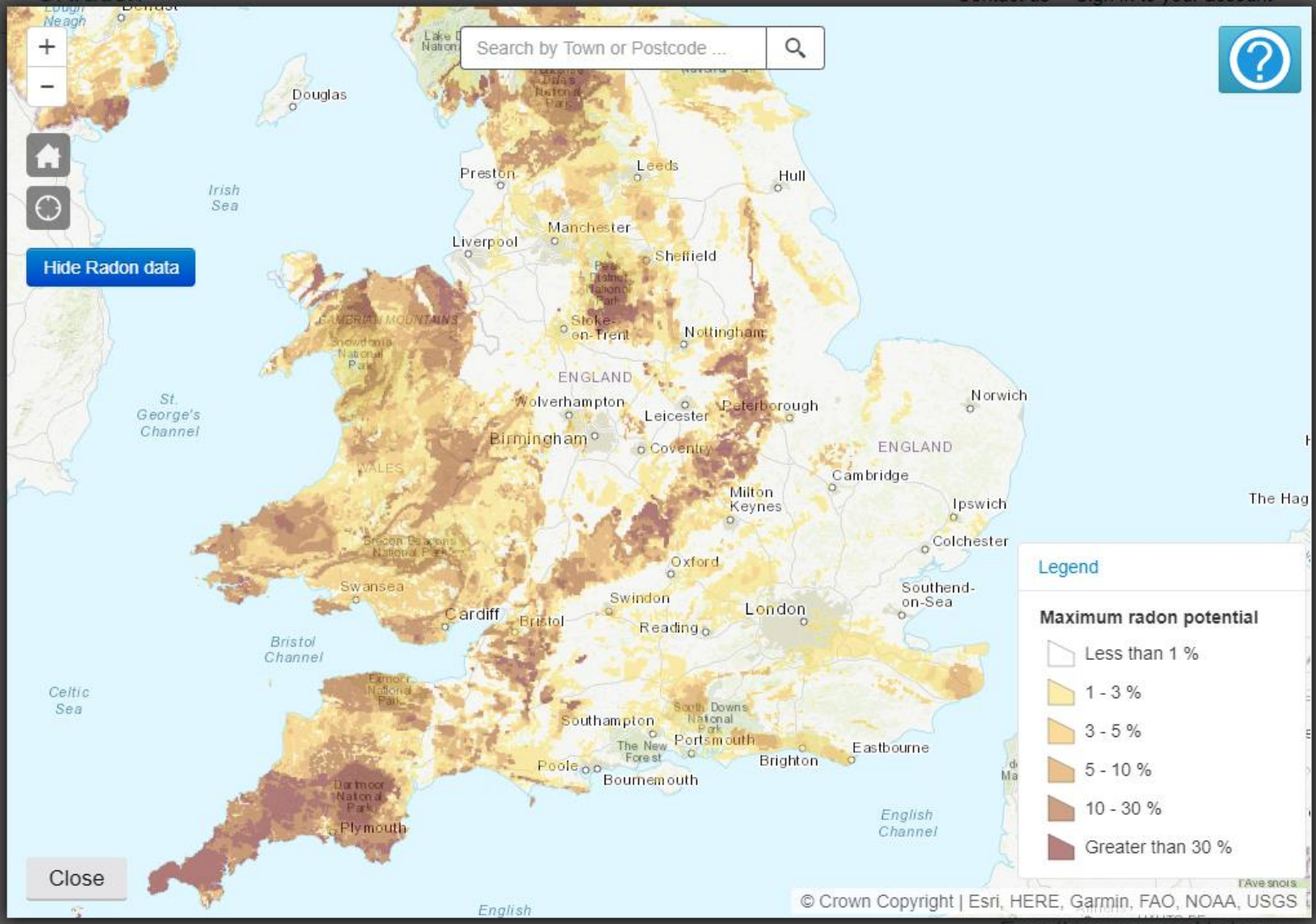
https://www.ukradon.org/information/ukmaps

https://home.sensibo

Public Health England

UKradon

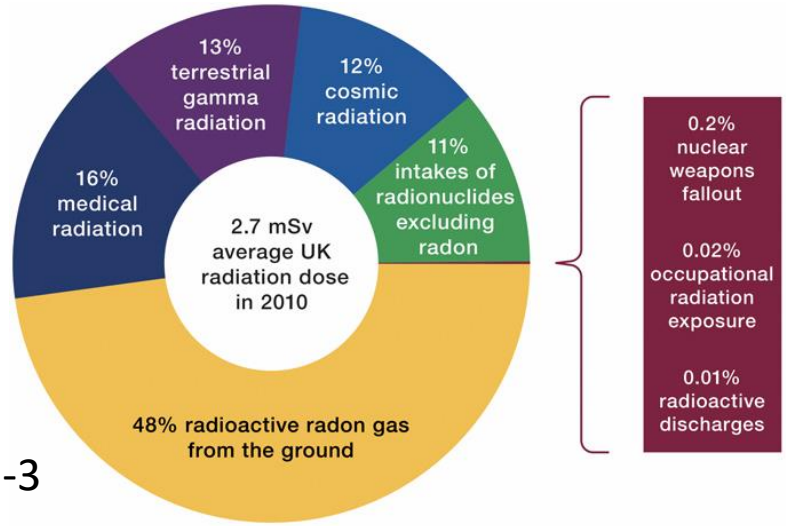
Contact us Sign in to your account



Everything you need to know about radon

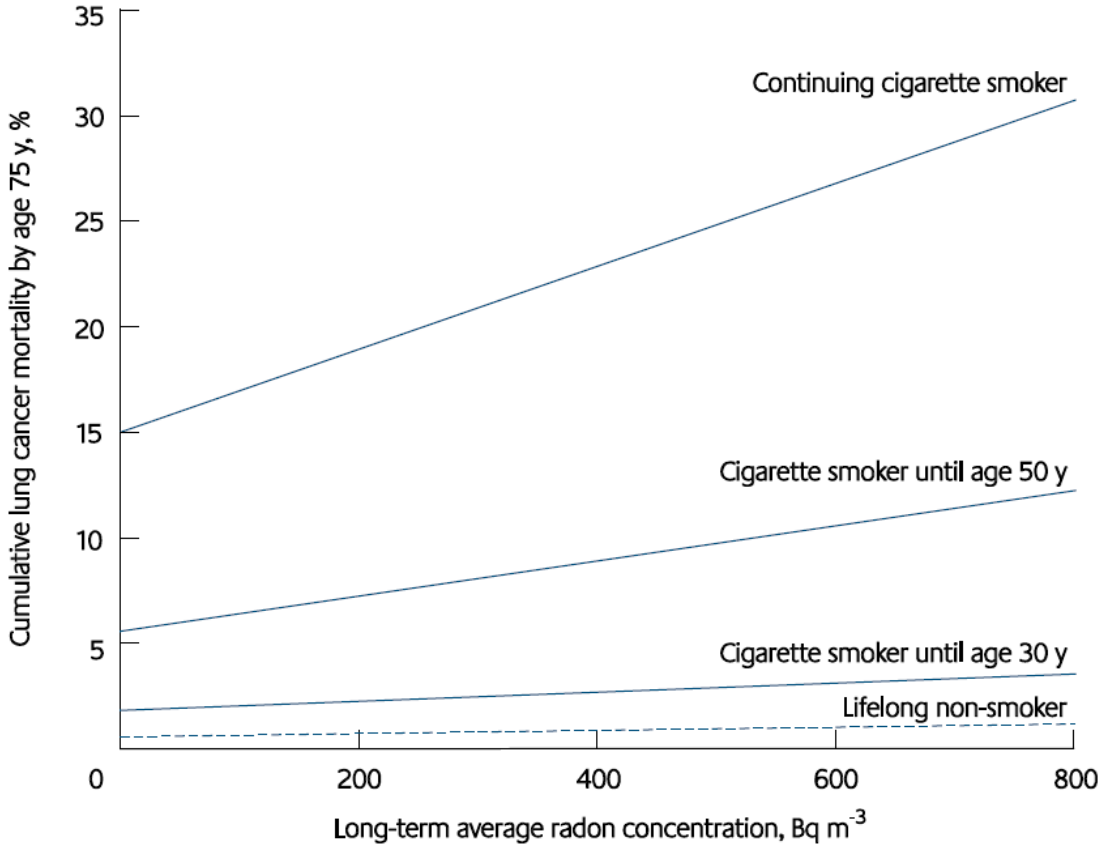
Effects of Radon

- Second-most important cause of lung cancer (after tobacco smoke)
- Smoking multiplies the effect of radon
- Accounts for approx. half the natural dose of radiation
- Workplace limit: 300 Bq/m3 annually



300 Bq m-3 × 2000 h × 6.7×10-6 mSv per Bq h m-3 = 4 mSv

Lung cancer risk from radon exposure in smokers and non-smokers



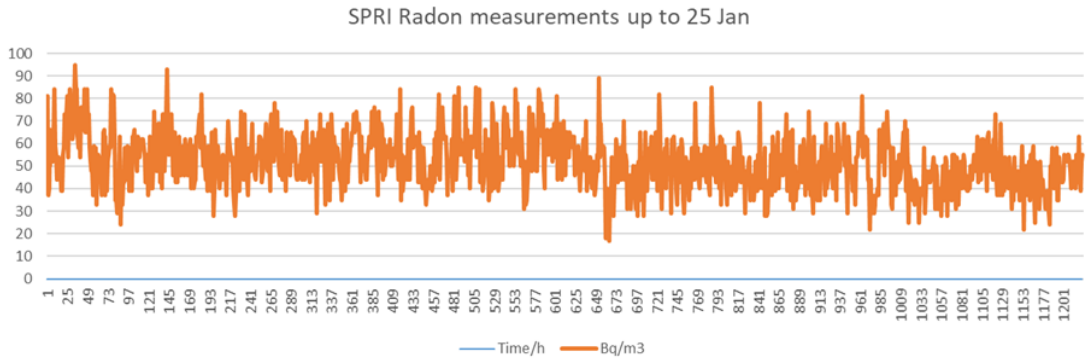
Cumulative absolute risk of death from lung cancer by age 75 years versus long-term average radon concentration at home for continuing cigarette smokers, ex-smokers and lifelong non-smokers in the UK (AGIR, 2009)

Detection of radon

- Inert, noble gas, but alpha radiation from Ra-222 (and progeny) can be detected
  - 3 month measurements with passive radon detectors (£25 ea)
  - 24h to week-long measurements with electronic radon monitors (~£200-£1000s)

- Electronic radon monitors, though not approved, are a useful quick, initial screening tool
- PHE advice: Risk assess all basement and below ground-level rooms occupied for more than an hour per week (may include monitoring)

Side by side comparison of electronic and passive radon sensor



~ 50 Bq/m3 annual average, data collected hourly
Quick feedback on effectiveness of control measures

35 Bq/m3 annual average, 3 month data collection period
Currently the only approved method.

Remediation measures

- New builds: radon impermeable membrane below lowest floor (especially in radon affected areas)
- Radon sump
- Improved ventilation

  e.g. radium store of SPRI: upgraded duct fan 1200 Bq/m3 -> 35 Bq/m3

  Door vent for passive ventilation

University-wide assessment

- Departments first, colleges, student accommodation
- Where possible involve RPS and DSO
- Emailed information sheet and return form
- Identify below ground level rooms and occupancy
- 24-72 h measurements, any readings over 100 Bq/m3 will be followed up
- Repeat every 10 years

University of Cambridge Radon Survery 2019

Dear Administrator, Building Manager, or RPS,

The University of Cambridge is committed to providing a safe and healthy work environment as required under the Management of Health and Safety at Work Regulations. One potential hazard for work indoors is accumulation of radon gas. Radon is the largest contributor to the natural radiation dose we all receive and the second most common cause of lung cancer after smoking. Radon is a naturally occurring, dense gas emanating from the ground. It can accumulate in below ground level rooms. Elevated radon levels are generally easily mitigated or managed, once identified.

This questionnaire will help us to identify rooms with a significant risk of radon levels close to the legal action level, which is set by the HSE in the Ionising Radiation Regulations. Based on the responses received we will perform initial checks with an electronic radon monitor. This will stay in the room for a few days. The recorded readings can be downloaded to any smartphone via Bluetooth, giving an hour by hour readout. Any average readings close to or above the action level will need to be followed up with longer measurements and mitigation measures implemented as necessary. More information can be found at www.ukradon.org/

Please reply by email to safety@cam.ac.uk within 2 weeks of receiving this letter. Tick-boxes in this form can be checked/unchecked by mouse click. Feel free to add further detail.

Completed by: Date:

Position: Email:

Department/Building and Address:

Do you have rooms ☐ fully or ☐ partially below ground level? If not ☐, no further action is required

Type of use: ☐Office ☐ Store room ☐ Plant room ☐ Other:

Occupancy: Is any person spending more than an average of 1 hour per week in that room?

☐ yes ☐ no

Are there any ☐ windows or ☐ light shafts?

Are the rooms mechanically ventilated?

☐ yes ☐ no

Any other comments

Comments from the Safety Office

Next steps and further information

If your building contains occupied below ground level rooms, we will probably include it in the programme of monitoring. Below are some details of the electronic and passive monitors used. We will loan out the electronic monitor and based on the readings we will decide on further measurements with the approved passive radon monitors. These single-use monitors are approximately £25 each and we would ask each Department to cover this small expense.

RadonEye

This is an electronic radon monitor with a sensitive pulsed ion-chamber detector. Current and average readings are shown on a small display on top and hourly readings can be downloaded via Bluetooth to any Apple or Android smartphone. It is mains power operated.

Electronic monitors, though more advanced and having a faster response time than the passive etched track monitors below, are not an approved method of measurement. We chose the RadonEye over other similar devices, because it uses the more sensitive ion-chamber technology instead of the simpler and less sensitive solid state, photo diode-like detectors of most other devices. We will use the results from the initial monitoring to decide on follow-up measurements with the passive monitors. The hour by hour readings are also useful to detect any re-occurring daily fluctuations. If remedial measures are necessary, the electronic monitor will give instant feedback on the effectiveness of these actions.

Passive radon detectors

UK Radon (part of Public Health England) supply and analyse single-use passive diffusion monitors which are placed at head height and stay in place for 3 months. These are etched track detectors, called so because alpha particles from the decay products of radon damage the surface of the detection medium producing microscopic tracks. These tracks are subsequently made visible by chemical etching.

There are a few points to consider with this type of monitor:

- Detectors can only be used at the address they were ordered for.
- The instructions provided with the detectors need to be followed correctly to get accurate results.
- Detectors record continuously and must be placed within a few days of receipt.
- The building should be in normal use during the measurement.
- Tests are less reliable if the building is empty for more than 2 weeks of the test.
- Tests are invalid if:
  - There is building work during the test
  - There is a change in use during the test