



BRIEFING
NOTE

No. 3

Geological Survey Ireland

Radon: A geological health risk that can be managed

Geoscience Information on Radon

This briefing note outlines the role geology plays in the distribution of radon in Ireland and how Geological Survey Ireland supports the identification of radon risk zones. Radon is a colourless, odourless, tasteless, radioactive gas that is the most common source of radiation exposure to the public¹. Radon is classified as a Class 1 human carcinogen. Ireland has some of the highest levels of radon in Europe and indoor exposure to radon has been linked to approximately 13.5% of Irish lung cancer cases². Radon originates in minerals within rocks and soil, which vary significantly across the country. Assessing sources and movement pathways of radon in rocks and soils assists with the identification and management of high radon areas.

Radon is an element which is derived from the decay of the radioactive elements uranium and thorium that occur naturally in rocks and soils. Radon gas migrates towards the ground surface through cracks and pores in the rocks either as a gas or dissolved in groundwater. Most radon enters the atmosphere and is diluted to very low concentrations, but people may inhale harmful amounts of radiation if radon accumulates in buildings.

The Environmental Protection Agency produces a radon risk map as a guide for householders and employers as to whether high concentrations of indoor radon are likely to be found in their building. In High Radon Areas in Ireland, it is a requirement of the Radiological Protection Act 1991 (Ionising Radiation) Regulations 2019 that all workplaces are tested for radon and all new buildings have radon membranes installed. The map also guides the Environmental Protection Agency in prioritising areas for customised radon awareness and mitigation programmes.

Geological Survey Ireland provides essential information to identify radon-prone areas, as shown in the diagram overleaf. Researchers in Geological Survey Ireland, the Environmental Protection Agency and Trinity College Dublin have combined extensive geological information with indoor radon measurements to develop a new radon risk map of Ireland³ that will guide the Environmental Protection Agency in identifying and understanding High Radon Areas.

Geological Survey Ireland is part of an interdepartmental coordination group implementing the National Radon Control Strategy to meet requirements of the Radiological Protection Act 1991 (Ionising Radiation) Regulations 2019 and European Council Directive 2013/59/EURATOM.

Indoor Radon Risk Maps

Probability that indoor radon concentration will be above national reference level.

<1% 1% - 5% 5% - 10% 10% - 20% > 20%

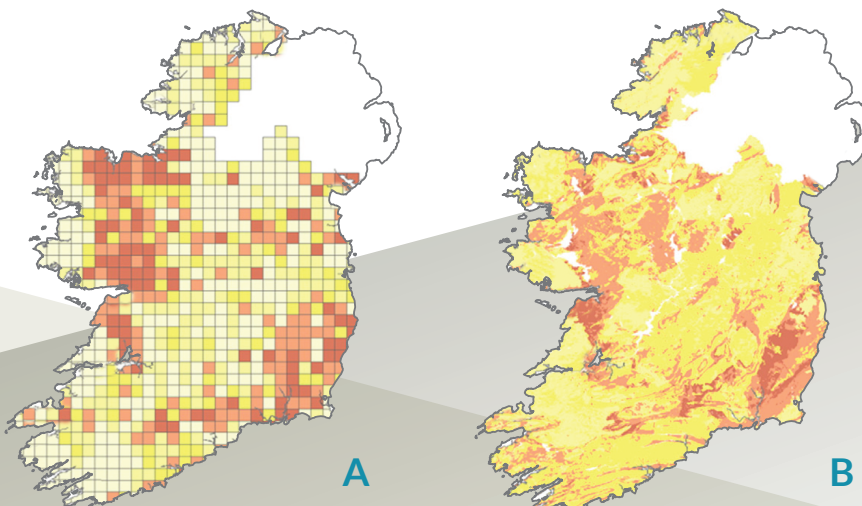


Figure 1. Indoor Radon Risk Map A: Radon risk map based solely on measured indoor radon levels collected by the Environmental Protection Agency³. **Indoor Radon Risk Map B:** Higher resolution radon risk map based on a combination of bedrock geology, Quaternary geology, subsoil permeability, aquifer type, and indoor radon measurements⁴.

Percentage bands show the probability of having an indoor radon concentration above the national reference level of 200 Bq/m³. Low risk = <5%; Medium risk = 5-10%; High risk = >10%.

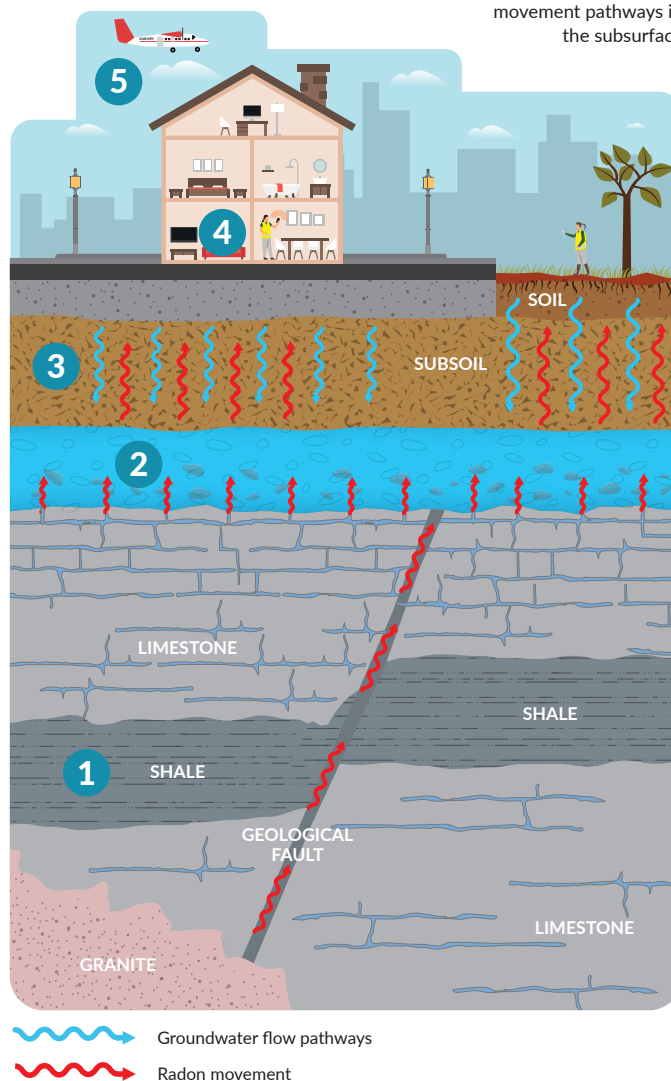
Information on radon from Geological Survey Ireland

Predicting radon risk is a complex task that requires an interdisciplinary approach. Many factors affect radon risk including rock type, subsoil type, movement in groundwater, building materials, ventilation, weather, and occupant lifestyles.

Geological Survey Ireland provides geological data, modelling and interpretation to help identify high radon areas.

- 1 Bedrock geology maps show the distribution and characteristics of rocks in Ireland. Some rock types such as granite or shales have higher natural radioactivity levels than others. Radon may move to the surface through fractures or pores in the rock.
- 2 Aquifer maps show information on bedrock or sand and gravel deposits that contain significant amounts of groundwater. Groundwater may transport dissolved radon over considerable distances from its source.
- 3 Quaternary geology maps show the nature and distribution of subsoil deposits - the material between bedrock and soil. Permeability (how easily water moves through the material) can also affect radon transport upwards to the ground surface.
- 4 The Environmental Protection Agency provides information on radon testing and remediation as well as collecting data on radon levels in buildings³.
- 5 Geological Survey Ireland's Tellus programme provides data useful for understanding geological sources of radon through its airborne geophysics, soil geochemistry and radon in groundwater work⁵.

Figure 2. Examples of radon sources and movement pathways in the subsurface



References

¹National Radon Control Strategy Coordination Group. 2019. National Radiation Control Strategy Phase 2: 2019-2024. <https://www.epa.ie/our-services/monitoring--assessment/radiation/national-radon-control-strategy/>

²Murphy, P., Dowdall, A., Long, S., Curtin, B., Fenton, D. (2021) Estimating population lung cancer risk from radon using a resource efficient stratified population weighted sample survey protocol – Lessons and results from Ireland. Journal of Environmental Radioactivity, 233, July 2021. <https://www.sciencedirect.com/science/article/pii/S0265931X21000540>

³Environmental Protection Agency (2021) Radon. <https://www.epa.ie/environment-and-you/radon/>

⁴Elio, J., Crowley, Q., Scanlon, R., Hodgson, J., and Long, S. 2017. Logistic regression model for detecting radon prone areas in Ireland. Science of the Total Environment 599-600, 1317-1329. <https://www.sciencedirect.com/science/article/abs/pii/S0048969717311713>

⁵Geological Survey Ireland (2021) Tellus programme web pages. <https://www.gsi.ie/en-ie/programmes-and-projects/tellus/Pages/default.aspx>

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