RADON, A SILENT GEOHAZARD

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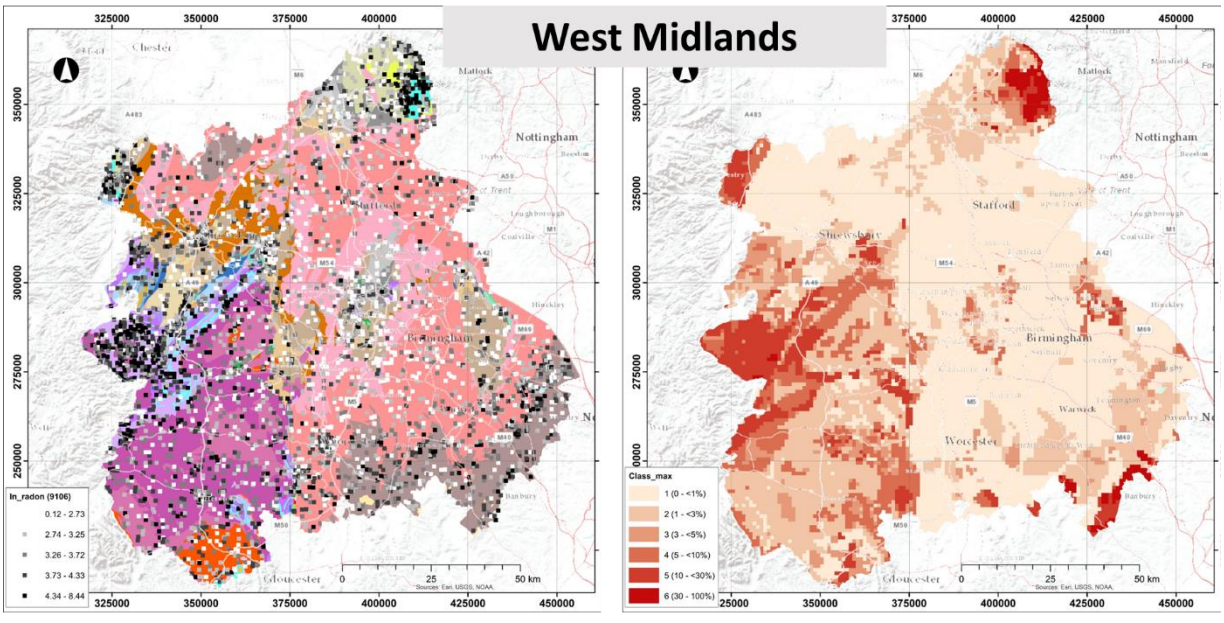
Abstract

Radon is a heavy, radioactive, geogenic gas with no colour, smell, taste or flammability. Radioactive means that its nucleus spontaneously decays to a lighter element while emitting radiation. Rn-222 (radon gas) is the most stable among the radon isotopes with a half-life of 3.8 days, decaying from Ra-226 in the U-238 series. Rn-220, with a half-life of 55.6 s, belongs to the Th-232 series and Rn-219, with a half-life of 3.96 s, belongs to the U-235 series. Radon gas (Rn-222) derives from uranium, which is ubiquitous through all types of rock and soil minerals. A portion of radon escapes from mineral grains and, as an extremely low chemically reactive gas, it escapes the ground according to permeability.

Radon is a health concern because it is the deadliest geohazard in the UK after being estimated to cause about 1,100 deaths per year (3.5% of all lung cancers). Outdoors radon gas dilutes to very low levels (4 Bq/m^3). However, radon level indoors can build up to high concentrations (above 200 Bq/m^3), posing a serious risk to health. The radon gas moves from the ground into the house due to the lower pressure and higher temperature indoors. The amount entering varying with time of day, week and season, and according to several factors, such as, geology, weather, type and conditions of house and life style (for example the ventilation habits).

Early detection of high indoor radon levels is essential. Therefore, the British Geological Survey (BGS) and UKHSA (UK Health and Safety Agency, former Public Health England PHE) have produced a series of maps showing radon affected areas based on underlying geology and indoor radon measurements. The radon map shows the likelihood of a house exceeding the UK action level (200 Bq/m^3). Most of the country has a probability less than 1%, with higher probabilities in granitic areas, particularly south-west England and in some limestone areas (largely due to high permeability and proximity to black shales). A new version of the GB radon map is to be released this November(!) following updates in radon measurements and geology.

Remedial work can be undertaken to reduce the passage of radon into existing houses, while new houses can be built to prevent the building-up of indoor radon.



Indoor Radon measurements (9106) + Geology → The (Indicative) Radon Map

Antonio Ferreira bio

Antonio Ferreira is an experienced Environmental Geochemist working for the British Geological Survey since 2014. He has a 5-year graduate degree in Geological Engineering, a MSc in Geochemistry and a PhD in Geosciences from the University of Aveiro (Portugal). His research contributed to development of the first low density geochemical mapping of Portugal. He also been involved in development work in environmental geochemistry of marine shelf sediments; digital geological mapping and 3D geological modelling (structure and properties) alongside the statistical analysis of U-Pb isotope ages in detrital zircons.

Since his arrival at British Geological Survey, he is working in collaboration with the UKHSA on the development and production of radon risk maps for the UK. He has developed research related with UK radon mapping and has been involved with the European radon community; his contributions have included work on the development of the recently published European Atlas of Natural Radiation.

He has been involved in Compositional Data Analysis and projects related to the statistical analysis and mapping of UK soil and stream sediment geochemical data, including projects related with strategic resources such as Lithium and Rare Earth Elements.