Geophysical Research Abstracts,
Vol. 11, EGU2009-4351-1, 2009
EGU General Assembly 2009

Seasonal Variability in European Radon Measurements

C.J. Groves-Kirkby, A.R. Denman, P.S. Phillips, R.G.M. Crockett, and J.M. Sinclair
University of Northampton, School of Applied Sciences, Northampton, United Kingdom
(chris.groves-kirkby@northampton.ac.uk)

In temperate climates, domestic radon concentration levels are generally seasonally dependent, the level in the home reflecting the convolution of two time-dependent functions. These are the source soil-gas radon concentration itself, and the principal force driving radon into the building from the soil, namely the pressure-difference between interior and exterior environment. While the meteorological influence can be regarded as relatively uniform on a European scale, its variability being defined largely by the influence of North-Atlantic weather systems, soil-gas radon is generally more variable as it is essentially geologically dependent. Seasonal variability of domestic radon concentration can therefore be expected to exhibit geographical variability, as is indeed the case.

To compensate for the variability of domestic radon levels when assessing the long term radon health risks, the results of individual short-term measurements are generally converted to equivalent mean annual levels by application of a Seasonal Correction Factor (SCF). This is a multiplying factor, typically derived from measurements of a large number of homes, applied to the measured short-term radon concentration to provide a meaningful annual mean concentration for dose-estimation purposes. Following concern as to the universal applicability of a single SCF set, detailed studies in both the UK and France have reported location-specific SCF sets for different regions of each country. Further results indicate that SCFs applicable to the UK differ significantly from those applicable elsewhere in Europe and North America in both amplitude and phase, supporting the thesis that seasonal variability in indoor radon concentration cannot realistically be compensated for by a single national or international SCF scheme.

Published data characterising the seasonal variability of European national domestic radon concentrations, has been collated and analysed, with the objective of identifying correlations between published datasets and local geographic/geological conditions. Available data included regional SCF figures from the United Kingdom and from France, together with nationally-consolidated results from a number of other European countries.

Analysis of this data shows significant variability between different countries and from region to region within those countries where regional data is available. Overall, radon-rich sedimentary geologies, particularly high porosity limestones etc., exhibit high seasonal variation, while radon-rich igneous geologies demonstrate relatively constant, albeit somewhat higher, radon concentration levels. Examples of the former can be found in the Pennines and South Downs in England, Languedoc and Brittany in France. Greatest variability is found in Switzerland, still subject to the ongoing Alpine orogeny, where the inhabited part of the country is largely overlain with recently-deposited light, porous sediments. Low-variability high-radon regions include the granite-rich Cornwall/Devon peninsular in England, and Auvergne and the Ardennes in France, all components of the Devonian-Carboniferous Hercynian belt, which extends from the Iberian peninsular through South-West Ireland and South-West England to France and Germany.