Geophysical Research Abstracts, Vol. 8, 01439, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01439

Increased domestic radon exposure caused by permafrost thawing due to global climate change

P.W.J. Glover

Département de géologie et de génie géologique, Faculté des sciences et de génie, Université Laval, Sainte-Foy, Québec, G1K 7P4, Canada (paglover@ggl.ulaval.ca / Fax : +1 418-656-7339)

Radon is a naturally occurring radioactive gas which accounts for approximately 9% of lung cancer deaths in Europe and 12% in the USA, and is considered to be the most serious environmental carcinogen by the EPA. The diffusive and advective transport of radon through the soil is controlled by the porosity, fluid saturations, diffusion coefficients and relative permeabilities of the soil. All of these parameters are significantly reduced in the permafrost that makes up one fifth of the Earth's terrestrial surface. We have carried out a pilot study involving the 2D numerical modelling of radon transport through soil, permafrost and a model unventilated model building. We find that the presence of the permafrost may act as an effective radon barrier even in the absence of advective transport. For the world average Ra^{226} activity of 40 Bq/kg, the permafrost seems to reduce the domestic radon concentrations by 80 to 90% (5 to 10 Bq/m^3) while leading to an increase in the concentration in the radon behind the barrier by 10 to 15 times (500 to 750 Bq/m^3). However, when we modelled the thawing of the permafrost that is beginning to occur as a result of global climate change the radon in the building increased transiently by up to 100 times (1000 Bq/m^3) over a timescale of several years before decreasing once again. It is therefore possible that a significant number of people could be exposed to levels of radon in excess of the 200 Bq/m^3 threshold that many countries adopt. This is particularly worrisome since it is recognized that although radon is known not only to be the most important cause of lung cancer after smoking, it has a much greater impact amongst smokers. This is especially important considering that the prevalence of smoking amongst the tribes of the Canadian Arctic and Greenland are 71% and 79% compared to a rate of 34% for Europe and Central Asia.