Geophysical Research Abstracts, Vol. 7, 08511, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08511

A multidisciplinary approach to radon hazard evaluation in the Oslo region

M.A. Smethurst (1), T.E. Finne (1), J.F. Dehls (1), T. Strand (2)
(1) Geological Survey of Norway, (2) Norwegian Radiation Protection Authority

Norway has one of the highest concentrations of radon-222 in indoor air in the world. This is due to the geology, climate and building construction methods. It is estimated that there are 150,000 residential buildings in Norway with radon concentrations over the intervention threshold of 200 Bq/m^3. Prolonged inhalation of radon daughters significantly increases the probability of developing lung cancer.

The present initiative differs from earlier studies in the Oslo region through the use of airborne gamma ray spectrometry (AGRS) to generate a high-resolution radium-226 map of the entire Oslo region. The data set is a compilation of 11 AGRS surveys covering 75 km x 140 km of the area around Oslo. (Line spacing 100, 200 and 250 m; elevation 60 and 80 m; speed 100 and 200 km/h; NaI detector volume 16 and 32 l; total flown profiles 50,000 km).

The map, verified by ground follow-up, is a measure of radon availability in the upper 30 cm of the ground. A multidisciplinary approach is required to (a) explain the highly variable spatial distribution of radon in the ground, and to (b) establish key relationships between radon in the ground outdoors and hazardous levels of radon indoors.

We have examined the relationships between equivalent radon availability (from AGRS), bedrock geology, overburden, surface conditions, groundwater, topography and the physical infrastructure of urban areas. The primary radon pattern clearly stems from large granite and mangerite bodies as well as the alum shale, and is in places strongly modified by fractures and faults, overburden, wetlands, and the fabric of the cities. Examples of these relationships will be shown.

The key question in this investigation is to what extent the quickly and cheaply obtained region-wide radon availability map can be used to determine the likelihood of

indoor radon levels exceeding some threshold value in any given geographic area.

The relationship between equivalent radon levels measured using AGRS and indoor radon levels is complicated by seasonal temperature and pressure differences between buildings and the ground, by choice of heating and ventilation methods, and by construction factors such as foundation type and use of membranes. Nevertheless, we have found a clear relationship between outdoor and indoor radon levels that can be applied on a large scale to predict the likelihood of indoor radon levels exceeding the Norwegian intervention level of 200 Bq/m^3.

We compared known radon levels for dwellings in the Oslo region with average (equivalent) radon levels within 200 m of those dwellings from AGRS mapping. We found a clear linear relationship between outdoor levels and the percentage of dwellings with radon levels over the intervention level. (The linear relationship holds between 0% and 70% and has a regression coefficient of 0.96.)

Applying this relationship, we have transformed the equivalent radon availability map from AGRS mapping into a simplified risk map, expressing estimated risk in terms of the probability of dwellings having radon levels in excess of the Norwegian intervention level. After further testing of the underlying the relationship for different categories of dwelling we hope that reliable risk maps may be produced that will be used to identify geographic areas with elevated risk and target them for closer investigation, and to aid in the planning and construction of new residential districts.