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Airborne gamma ray surveying in radon hazard evaluation: a case study from Norway

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The Geological Survey of Norway and Norwegian Radiation Protection Authority have established an approach to mapping radon hazards in Norway based on direct measurements of radon in indoor air, bedrock and drift geology mapping, and the mapping of radium in the ground using helicopter- and aeroplane-borne gamma-ray surveys. Existing indoor radon measurements are used to establish hazard profiles for the other three data sets. The multiple indications of hazard, from all four data sets, are then combined into a single hazard prognosis map.

We have looked closely at the efficiency of the mapping method in the municipality of Gran (north of Oslo). The uranium rich alum shale and superficial deposits associated with it are the principal sources of indoor radon in the area. Small isolated granite bodies and local high permeability glacio-fluvial deposits contribute to the hazard picture. The method produces a liberal hazard map that encloses most of the known areas of severe radon contamination in dwellings and identifies additional uninhabited areas where similar levels of contamination can be expected (without mitigating action). The hazard evaluation in the Gran area is 81% efficient at enclosing high indoor radon measurements in the high hazard zone when this zone occupies 50% of the total geographic area. The probability of this distribution happening by chance is 0.054%.

Of course, indoor radon measurements are the most valuable data set for establishing radon hazard levels accurately, but only where these measurements are abundant. In Norway such areas are very limited in spatial extent. We find airborne measurements to be the most effective supplementary data, followed in usefulness by knowledge of the bedrock geology and drift geology (at the 1:50,000 mapping scale).

A further opportunity to test and refine our approach to radon hazard evaluation presents itself now with a new airborne gamma-ray survey over the Kongsberg region southwest of Oslo. The survey is currently underway over a geologically complex area known to be strongly affected by radon. A test of the approach in this area will be entirely independent of earlier studies and we are currently unaware of how well the hazard evaluation will perform. We expect to be able to show results from this survey during the meeting.