A GIS Approach to Produce a Map of the Potential for Radon in Indoor Air in Nova Scotia

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The Mineral Resources Branch initiated a project in 2007 utilizing a GIS-based approach to produce a map of the province showing the potential for radon in indoor air (O'Reilly et al., 2010). Radon is a naturally occurring, radioactive gas produced from the radioactive decay of uranium, and is the second leading cause of lung cancer after smoking and is the leading cause of lung cancer in non-smokers. There have been studies in the past (e.g. Jackson, 1990) that clearly demonstrate certain geological regions of the province are prone to having homes exceeding the Health Canada established guideline of 200 mBq/m^3 for radon in indoor air. In some cases, homes as high as 20 times the guideline have been reported. No region in the province is devoid of homes exceeding the Health Canada guideline, which leads government to recommend that all homeowners should test their home for radon. However, it is thought that a map showing regions where there is a higher likelihood of having homes in exceedence would be useful to other government agencies, land-use planners, real estate agents and the general public.

An early attempt to produce a map showing the potential for radon in homes was done in 2003 (O'Reilly, 2009). This map drew solely on federal government airborne radiometric surveys for uranium as well as subjective knowledge of the uranium content of the various geological terrains in the province. Since then, several jurisdictions in Europe have successfully used a GIS-approach to produce radon potential maps (e.g. Smethurst et al., 2008). We felt that a similar GIS model could be employed in Nova Scotia. Our GIS-based approach incorporates 3 province-wide data layers: airborne radiometric surveys for equivalent uranium (eU); bedrock geology; and soil permeability. For soil permeability we utilized the federal Department of Agriculture county soil maps in which soil drainage estimates (permeability) are provided. We first took the bedrock geology layer and used available geochemical data for uranium content and subjective knowledge of staff geologists, and scored each geological unit from 1 to 100 as to its radon producing potential. Similarly, each individual unit in the soils layer was assigned a radon producing value between 1-100 based on its permeability characteristics. The eU layer was normalized from 0-100 by assigning the highest recorded reading in the survey a value of 100 and scaling all other readings accordingly. Each layer was then gridded at 250x250m and the GIS model run with a 1:1:1 weighting relationship between the 3 data layers. The GIS program selected the radon score for each grid cell from each of the 3 layers and combined their total on a Radon Potential Score map. Our next step will be to ground proof the radon potential score map against existing radon in homes data and radon in soil gas survey results with an aim of determining percentage exceedence thresholds relative to the radon potential score categories.

References

Jackson S. A. 1990: A survey to measure domestic concentrations of radon gas in Nova Scotia, part 1, screening survey; Nova Scotia Department of Health, unpublished report, 30p.

O'Reilly, G., A. 2009: Map showing potential for radon in indoor air in Nova Scotia; in Mineral Resources Branch, Report of Activities 2008; Nova Scotia Department of Natural Resources, Report ME 2009-1, p. 111-113.

O'Reilly, G. A., Goodwin, T. A. and Fisher, B. E. 2010: A GIS-based approach to producing a map showing the potential for radon in indoor air in Nova Scotia; in Mineral Resources Branch, Report of Activities 2009; Nova Scotia Department of Natural Resources, Report ME 2010-1, p. 95-97.

Smethurst, M. A., Strand, T., Sundal, A. V. and Rudjird, A. L. 2008: Large-scale radon hazard evaluation in the Oslofjord region of Norway utilizing indoor radon concentrations, airborne gamma ray spectrometry and geological mapping; Science of the Total Environment, v. 407, p. 379-393.

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