A comprehensive review of radon resistant construction, migration requirements and options in Ontario

Effectively controlling indoor radiation levels

BY BRUCE DECKER, C.E.T., BSSO, RHT AND BOB WOOD

In 2012, the Canadian Nuclear Safety Commission reported radiation exposure from inhaled radon gas impacts the health of all types of building occupants across Canada, and is the largest contributor to an individual's annual radiation exposure. They also shared with Canadians that recent efforts to investigate the direct association between indoor radon and lung cancer have provided convincing evidence of increased lung cancer risk at levels commonly found in buildings and recognized radon as the second-leading cause of lung cancer, after smoking, in the general population.

A radioactive, colourless and odourless gas, radon (and its radioactive progeny, polonium, bismuth and lead) is the byproduct of the radioactive decay of uranium which is distributed in rock and soil. Once uranium decays to radon gas it is mobilized by pressure and concentration gradients and moves through rock and soil pore spaces. Stack effect draws radon into buildings where it can accumulate and expose occupants to elevated levels.

In March 2012, Health Canada completed a random, cross-Canada survey of radon concentrations in nearly 14,000 homes. The results from this two-year study concluded that 6.9 per cent of Canadian homes have radon levels above the current radon "actionable level" of 200 becquerel per cubic metre of air. Subsequent efforts including, risk communication strategies, public education and changes to building codes have been and are continually implemented to protect Canadians from radon exposure.

Evidence shows conventional building construction methods do not adequately control its ingress and that additional measures to mitigate its infiltration are warranted. There are many challenges and potential shortcomings with the minimum building code requirements that could result in elevated radon in buildings. More importantly, designers, constructors, authorities, building owners and occupants may falsely assume a prescriptive code requirement was met and the occupants are safe from radon overexposure.

Radon cannot be "sealed out" with conventional construction methods and the extreme level of quality control to do so is cost prohibitive. Simple modifications to conventional building methods can provide passive enhancements that significantly improve radon mitigation system performance and dramatically reduce operational energy costs. Although tight building envelopes provide energy reduction benefits, without purpose built ventilation (i.e. active sub-slab depressurization, dilution ventilation) an increase in indoor radon levels and subsequent risk of lung cancer for building occupants may result.

In situations where active mitigation systems must be implemented to adequately control radon levels, favouring active sub-slab depressurization methods over general dilution ventilation will further control energy consumption and associated heating ventilation and air conditioning operation and maintenance costs.

Although dilution ventilation is a viable option for radon control, building occupants are still at risk of greater radon exposure than active sub-slab depressurization. In large-scale buildings with dynamic monitoring and ventilation systems and active sub-slab depressurization or dilution ventilation, indoor radon levels are often effectively controlled and energy expenditure requirements are reduced up to 94 per cent.

Bruce Decker, C.E.T., BSSO, RHT is senior technical advisor at Safetech Environmental Limited and Bob Wood is president of Mr. Radon.