Concrete Tech Tip # 18

Radon Resistant Buildings

1. WHAT is Radon?

Radon is a colorless, odorless, radioactive gas which occurs naturally in soils in amounts dependent upon the geology of the location. The rate of movement of radon through the soil is dependent primarily upon soil permeability and degree of saturation, and differences in air pressure within the soil. Soil gas enters buildings through cracks or openings in the foundation, slab, or basement walls when the air pressure in the building is less than that of the soil.

Radon gas decays to other radioactive elements in the uranium series. Called "radon progeny", they exist as solid particles rather than as gas.

2. WHY be Concerned About Radon Levels in Buildings?

The concern is due to an association with the development of lung cancer. Radon progeny can become attached to dust particles in the air. If inhaled, they can lodge in the lung. Energy emitted during radioactive decay while in the lung can cause tissue damage which has been linked to lung cancer.
The level of health risk associated with radon is related to the concentration of radon in the air and the time a person is exposed to that air. The Government of Canada has recently (2007) updated their guideline for exposure to radon in indoor air and has set their limit at 200 Bq/m^3 It has also outlined remedial measures that should be taken whenever indoor air conditions exceed this limit. The 2014 Alberta Building Code (ABC) mandates that the construction of new dwellings should employ techniques that will minimize radon entry and that will facilitate post-construction radon removal, should this subsequently prove necessary.

3. HOW to Construct Radon Resistant Buildings Using Concrete.

The Alberta Building Code specifies the use of a polyethylene air barrier directly beneath any interior concrete floor slab on grade with continuity mandated across all slab, wall and abutment intersections as well as lining sumps and sealing all slab perforations by utilities and columns to help achieve this goal.
Regardless of whether unacceptable radon levels are expected, the ABC further stipulates a “roughed in’ installation of a sub-slab depressurization system incorporating either, a prescribed minimum 100 mm layer open-graded aggregate base or a performance proven gas-permeable alternative material, that forms a conditioned space between the air barrier and the ground. These systems provide a positive means of evacuating soil gas from beneath the slab, diverting it directly to the outside of the building envelope As more and more project specifications require the use of polypropylene sheets as vapour retarders or air barriers directly beneath concrete slabs, placing and finishing contractors are working more closely with their concrete suppliers to select mix designs that help them to maintain productivity along with finished product quality and durability. For more information on how proper concrete mix design selection can help you maintain your business efficiency and reputation, contact your local concrete supplier.

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Concrete Tech Tip #11: Curing In-Place Concrete, Alberta Ready-Mixed Concrete Association, Edmonton, AB.
Concrete Tech Tip #29: Vapour Retarder Under Slabs on Grade. Alberta Ready-Mixed Concrete Association, Edmonton, AB. Reviewed and revised 2016.

References
National Building Code of Canada 2010. National Research Council of Canada 2010, Ottawa, ON.
CIP #18: *Radon Resistant Buildings*. Concrete in Practice Series with permission from the NRMCA.
“Radon Reduction in New Construction – An Interim Guide,” U.S. Environmental Protection Agency, OPA-87-009, 1987, 7pp. Available from EPA (513) 569-7771.
“Radon Reduction Techniques for Detached Houses – Technical Guide,” U.S. Environmental Protection Agency EPA/625/5-86/019,19N, 50 pp. Available from EPA Center for Environmental Research Information, (513) 569-7562.
Alberta Building Code 2014. National Research Council of Canada, Ottawa.

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Soil Gas Depressurization System Rough-In

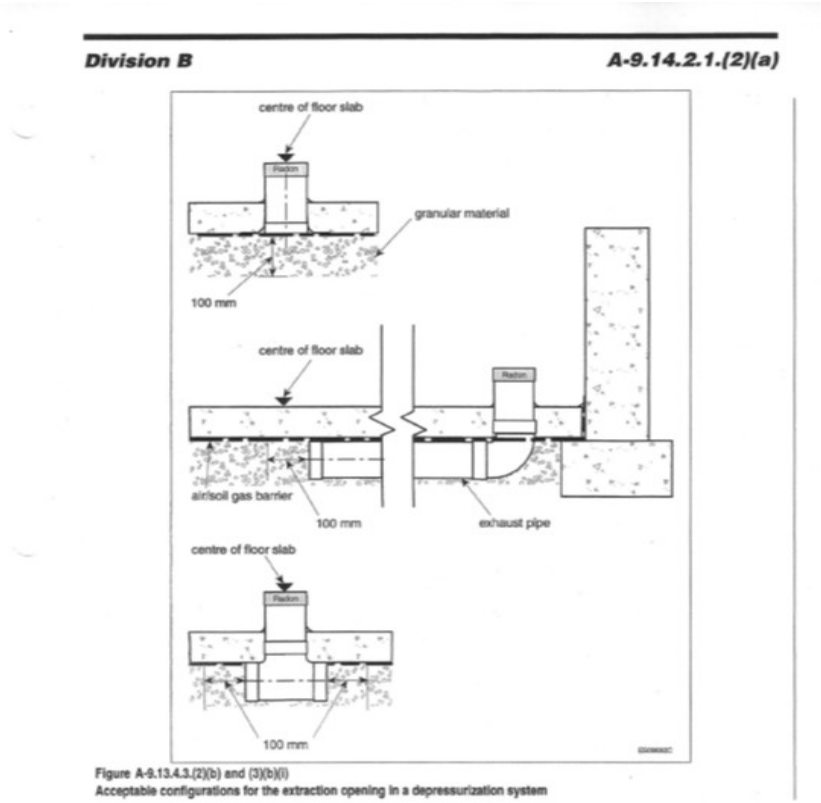

Figure A-9.13.4.3.(2)(b) and (3)(b)(i)
Acceptable configurations for the extraction opening in a depressurization system

Follow these guidelines to reduce radon entry:

1. Design to minimize utility openings. Sump openings should be sealed and vented outdoors.
2. Minimize random cracking by using control and isolation joints in walls and floors. Planned joints can then be easily sealed.
3. Use materials which will minimize concrete shrinkage and cracking (larger aggregates sized and lower water-cementitious ratio - 0.55 or less). See CTT 29.
4. Pour the concrete directly on the Polyethylene air barrier to minimize the potential for Radon gas migration above the slab.
6. Remove grade stakes after striking off the slab. (If left, they can provide entryways through the slab).
7. Construct the joints to facilitate caulking.
8. Cure the concrete adequately. See CTT 11.

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