

Radon Monitoring & Remedial Works:- a case study

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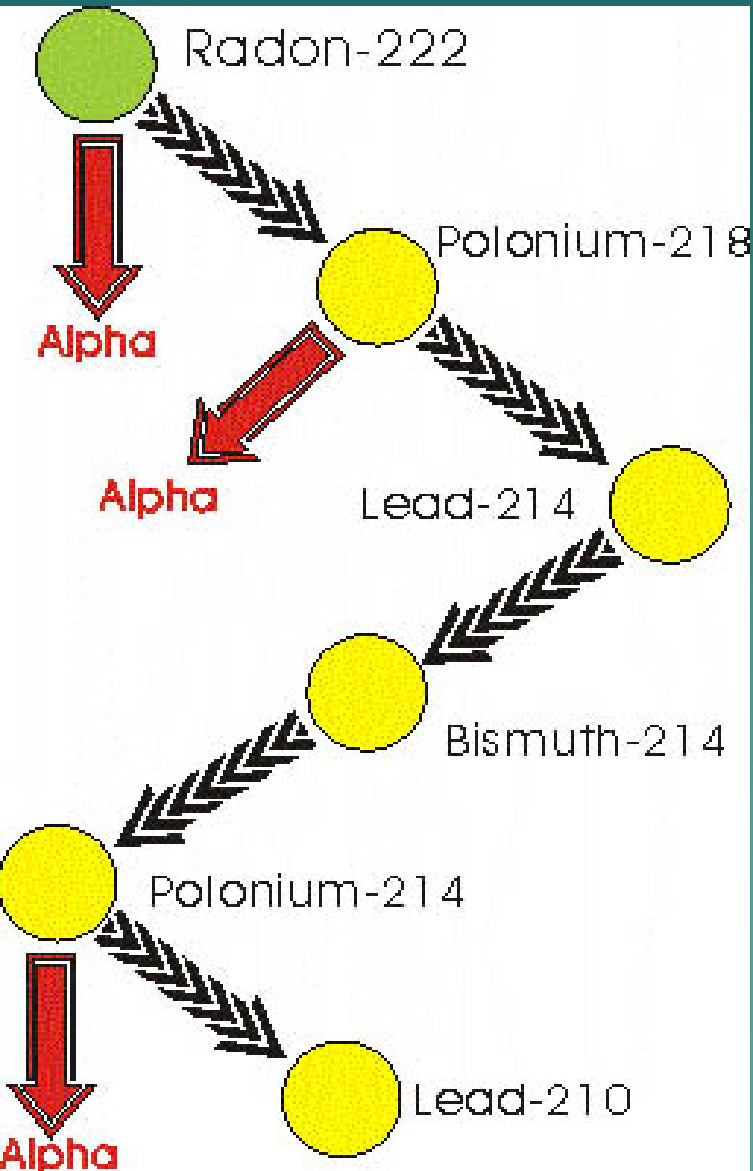
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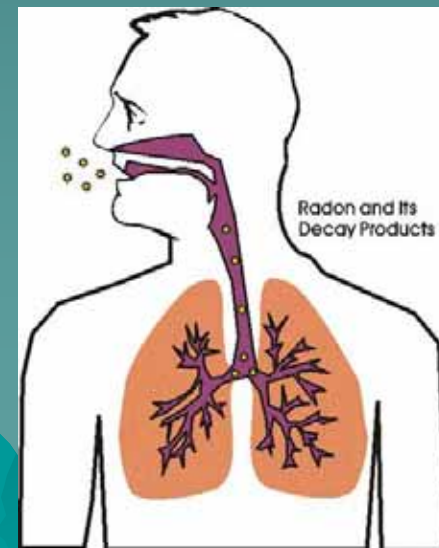
Radon

- ◆ A radioactive gas naturally emitted by building materials and soil.
- ◆ A daughter in the decay series of Uranium.
- ◆ A parameters of Indoor Air Quality
 - HKEPD recommends 200 Bq/m^3
 - USEPA recommends 150 Bq/m^3
- ◆ An indicator of ventilation problem

Radon



- ◆ Radon and its decay daughters emit alpha particles ;
- ◆ giving high radiation dose to the lung;
- ◆ risk of **lung cancer**.



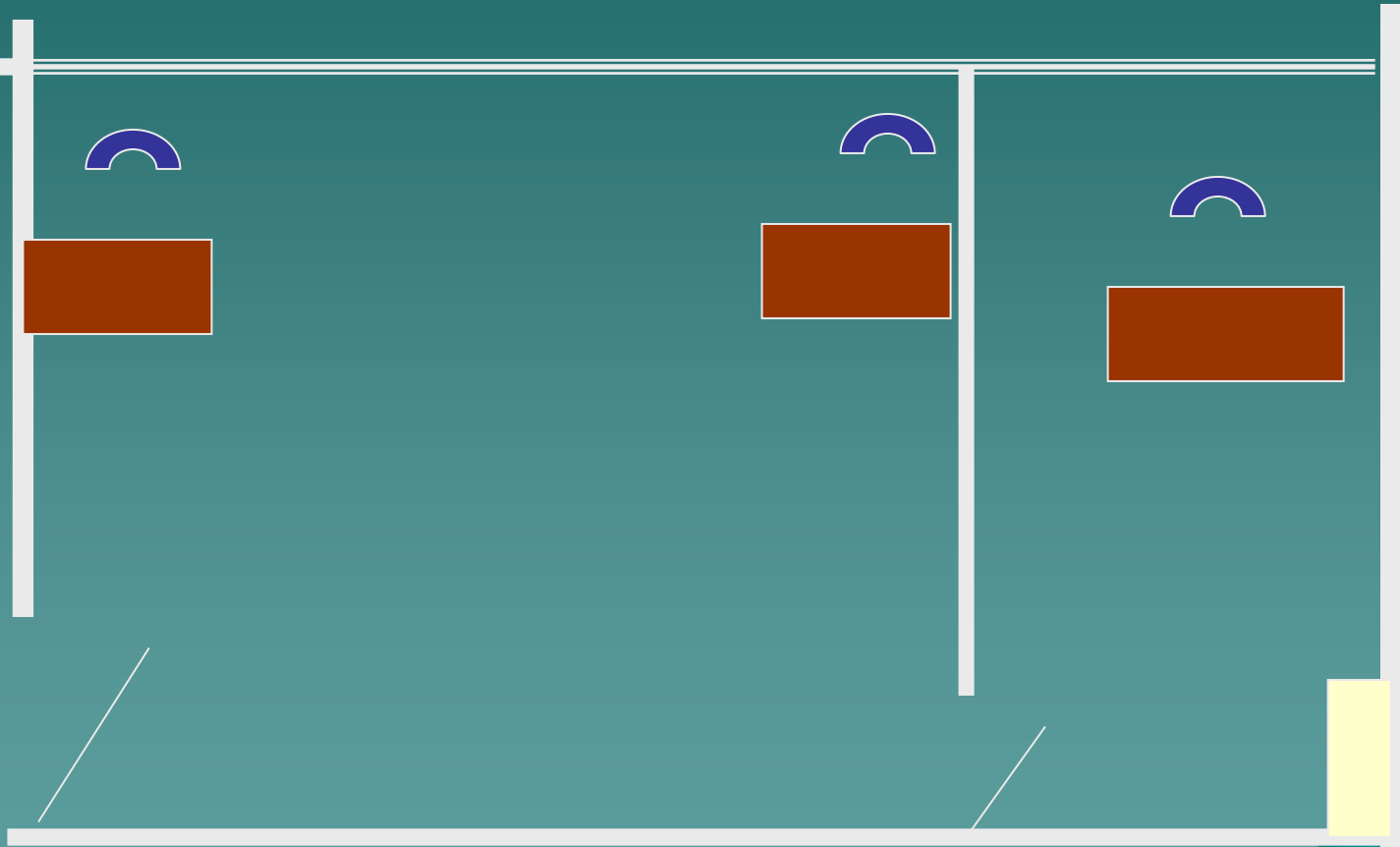
The Story

- ◆ In a indoor air quality (IAQ) survey, a 900 Bq/m³ radon concentration was found in an office on the ground floor of a building.
- ◆ Remedial works was commenced and the radon concentration was monitored at each stage of the remedial works.

Background

- ◆ The building was built 30+ years ago.
- ◆ The office on the ground floor had window type air conditioners installed.
- ◆ Occupiers of the room may open the windows for natural ventilation when the air conditioners were not in use.

The Office



Background: The Office

- ◆ The office was about 8.2 m x 6m x 3m (height) and occupied by a professor and his secretary.
- ◆ Some walls were concrete while others were gypsum boards.
- ◆ The floor is concrete covered by carpet.

Remedy works

1. installation of 2 exhaust fans
(capable to exhaust $420 \text{ m}^3/\text{h}$ each);
(Maximum 9 air changes/h)



Remedy works

1. 2 exhaust fans
(capable to exhaust $420 \text{ m}^3/\text{h}$ each);
2. **installation of a ventilation unit**
which can provide 720 m^3 per hour
of air change;
(5 air changes/hr)

Installation of ventilation unit





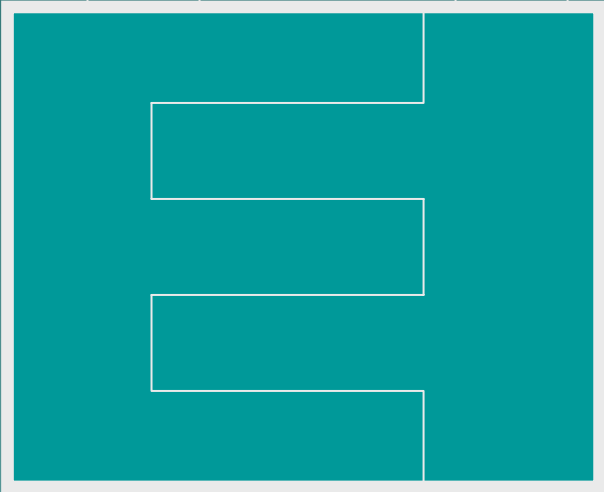


Fresh air intake

exhaust



Heat exchanger



Remedy works

1. installation of 2 exhaust fans (capable to exhaust 420 m³/h each);
2. installation of a ventilation unit which can provide 720 m³ per hour of air change; and
3. covering the floor with **epoxy coating**.





Measure Radon level



The Results

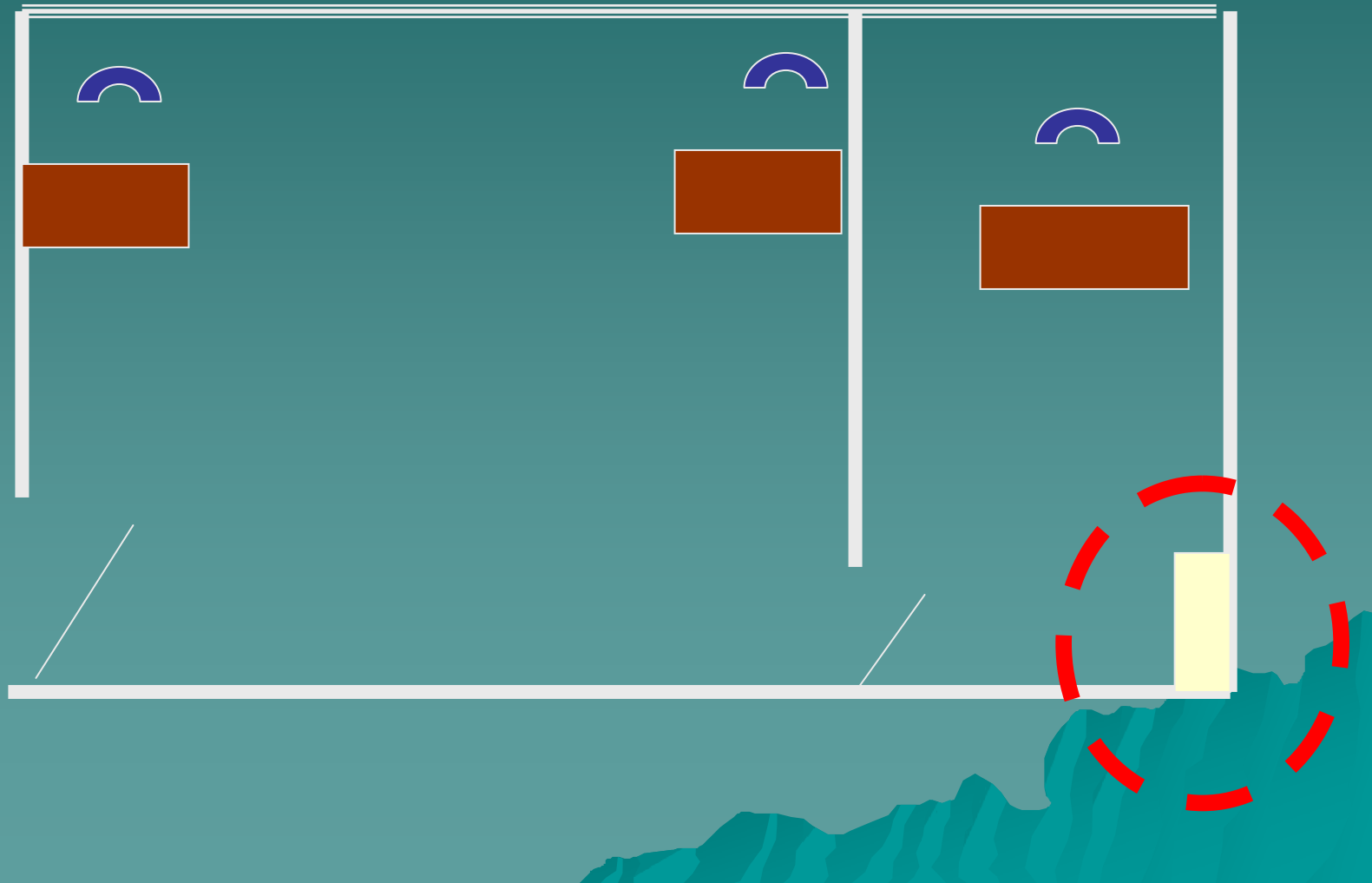
24 hr-Average Radon Concentration (Bq/m ³)	Exhaust Fans	Ventilation Unit
567	Off	Off
943	On	Off
370	Off	HI
516	On	HI

Sealing off any possible leaks





The room

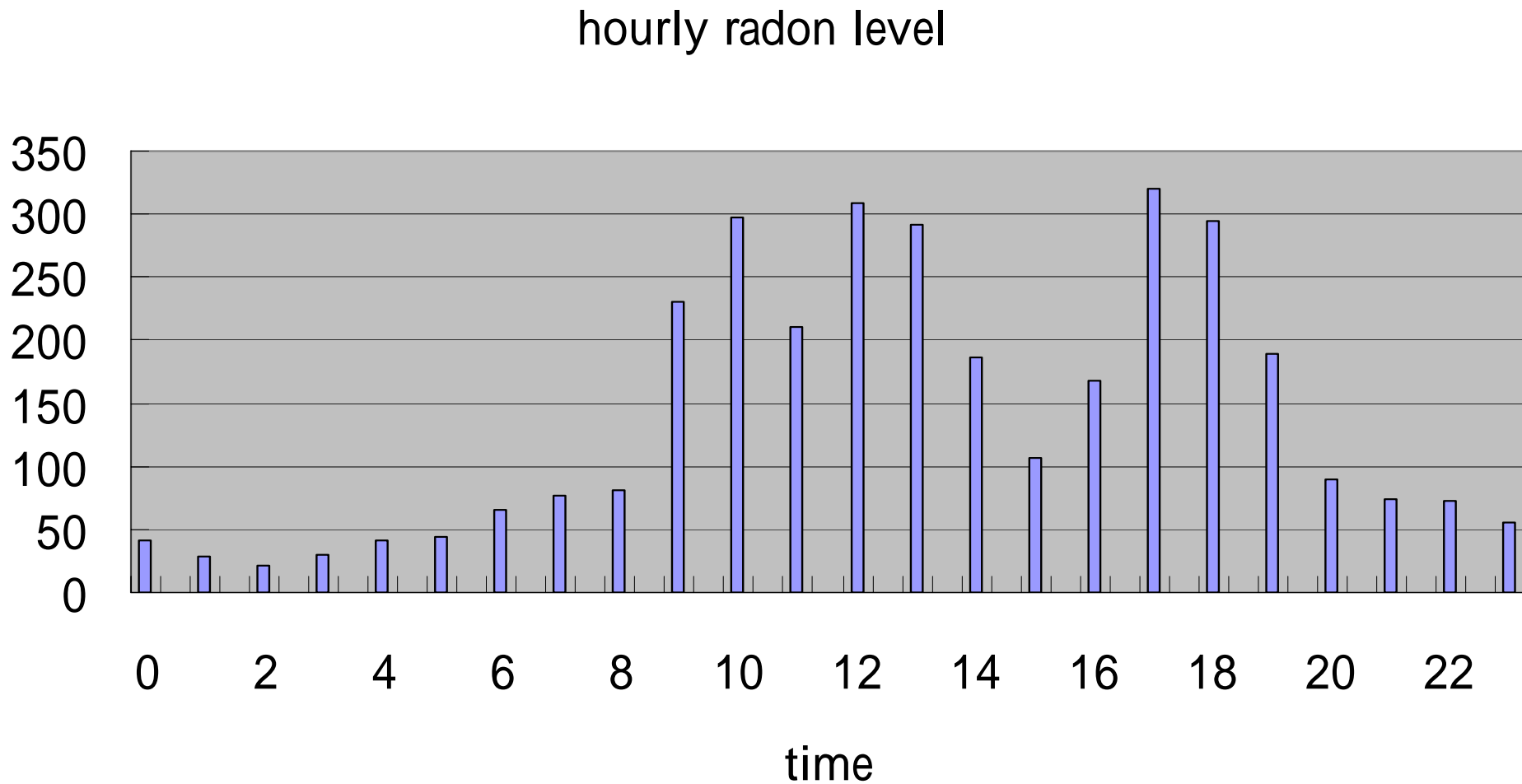




The Result

24 hr- Average Radon Concentration (Bq/m ³)	Exhaust Fans	Ventilation Unit
220	Off	Off
142	Off	HI
190	On	HI

Another room with exhaust fans



Radon measurement



Radon Measurement



Conclusion from this study

- ◆ The main source of radon in this room is from soil.
- ◆ Operation of exhaust fans without makeup air will generate a negative pressure and resulting in higher radon levels.
- ◆ Remedial works including sealing off the entrance of gas from soil and installing ventilation unit can control the radon concentration successfully.

Strategies Developed

- ◆ For high radon rooms
- ◆ For new building
 - Investigation of radon in soil gas
 - the Design

Potential Entrance of Radon



Potential Entrance of Radon



Investigation of Radon in soil



Potential source of Radon



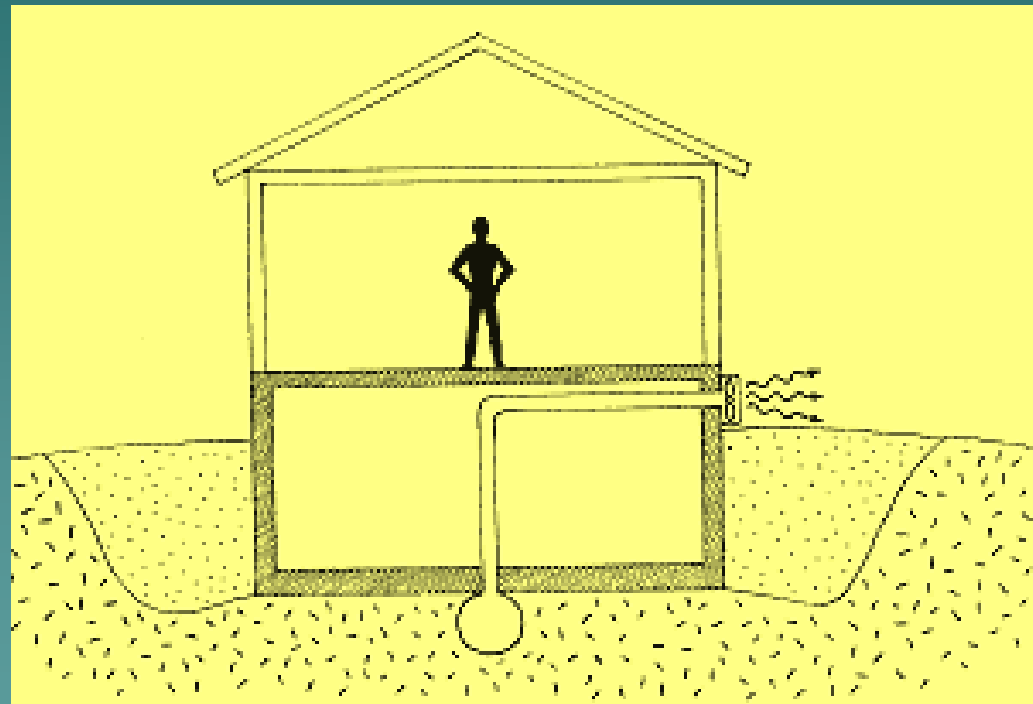
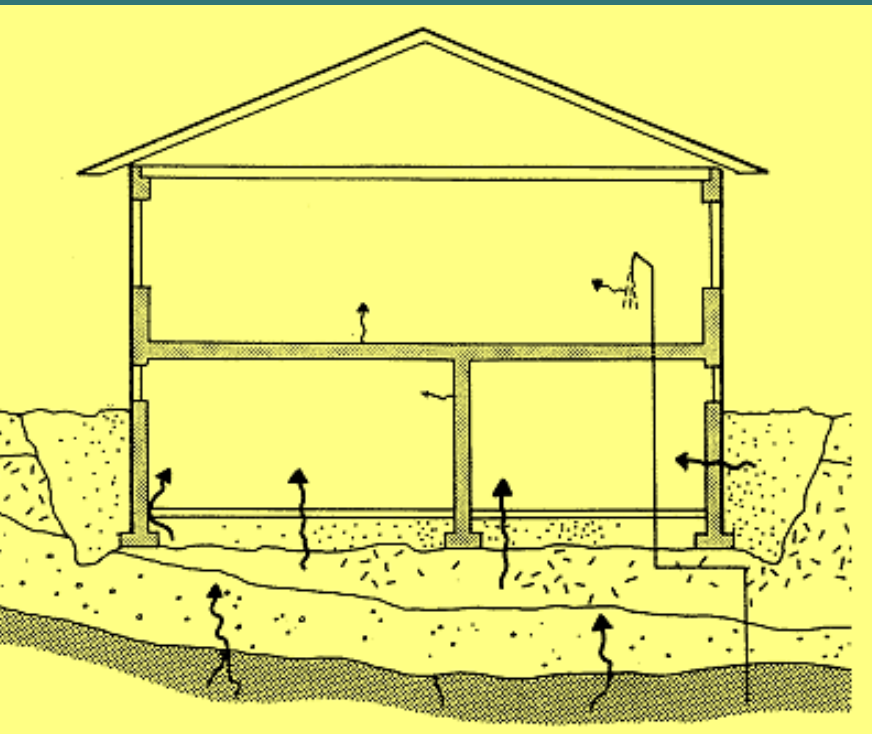
Suggestions for new buildings



Suggestions for New Buildings



Summary



Reference

- ◆ <http://en.wikipedia.org/wiki/Radon>
- ◆ <http://www.iaq.gov.hk>
- ◆ <http://www.epa.gov/radon/index.html>
- ◆ <http://www.hse.gov.uk/radiation/ionising/radon.htm>
- ◆ <http://www.mitsubishi-ryoden.com.hk>