

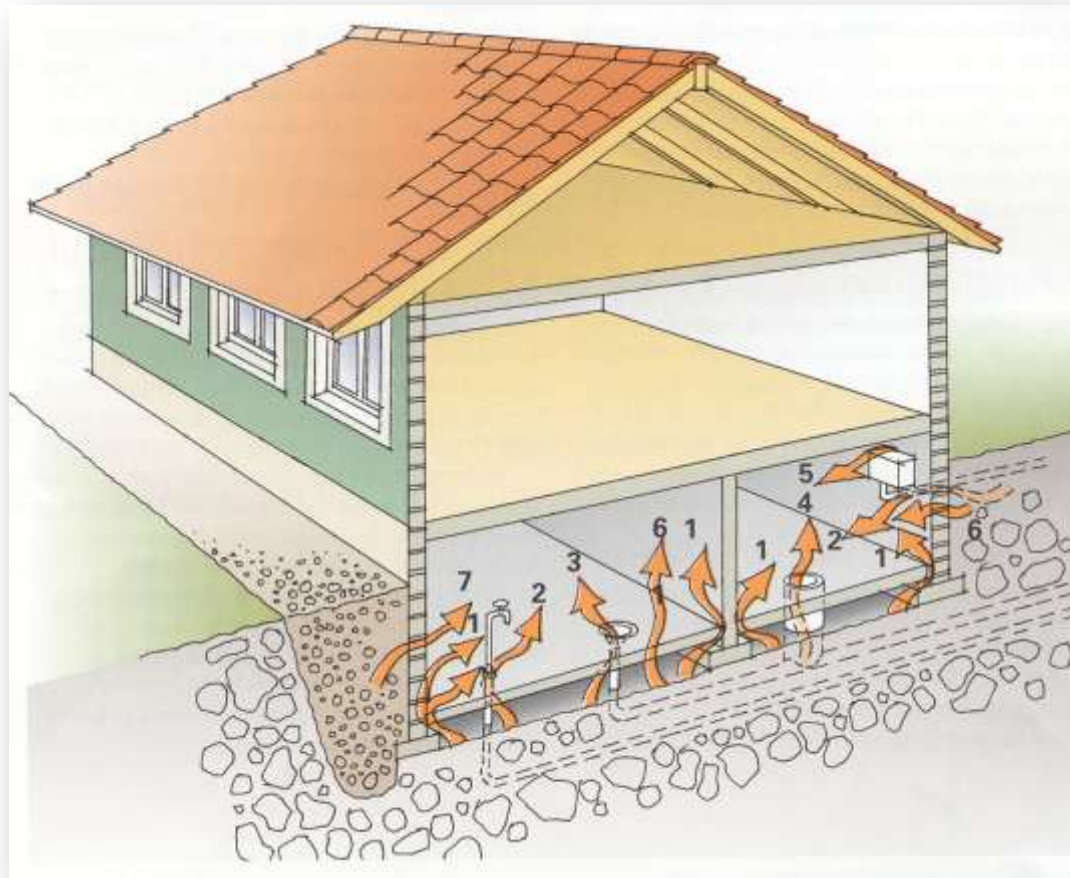
Practical aspects on radon remediation

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EARST Workshop, Bouillon, Belgium
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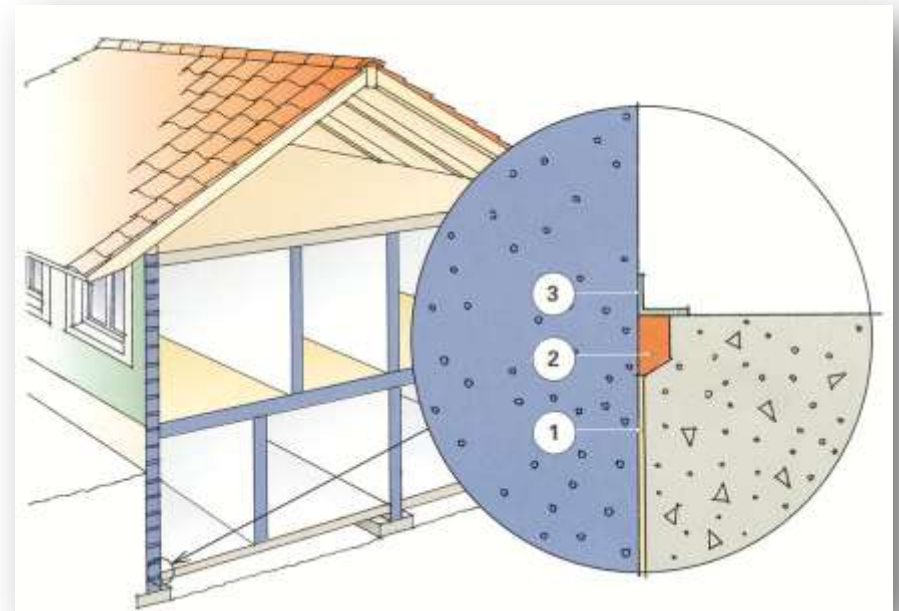
Remediation actions

- **Sealing of leakage points**

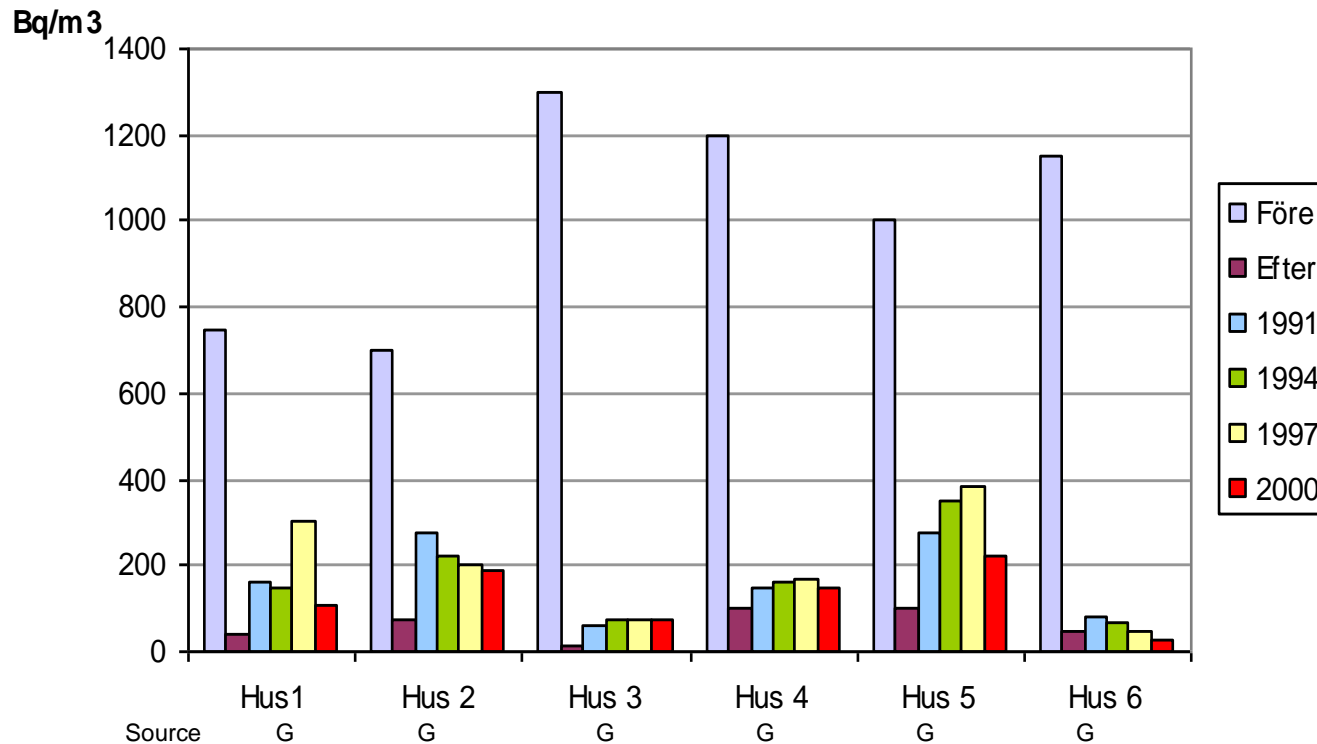


Sealing of leakage points

- Repair damaged concrete.
- Sealing around pipes.
- Sealing of service hatches.
- Sealing of cracks by milling and moulding with concrete.

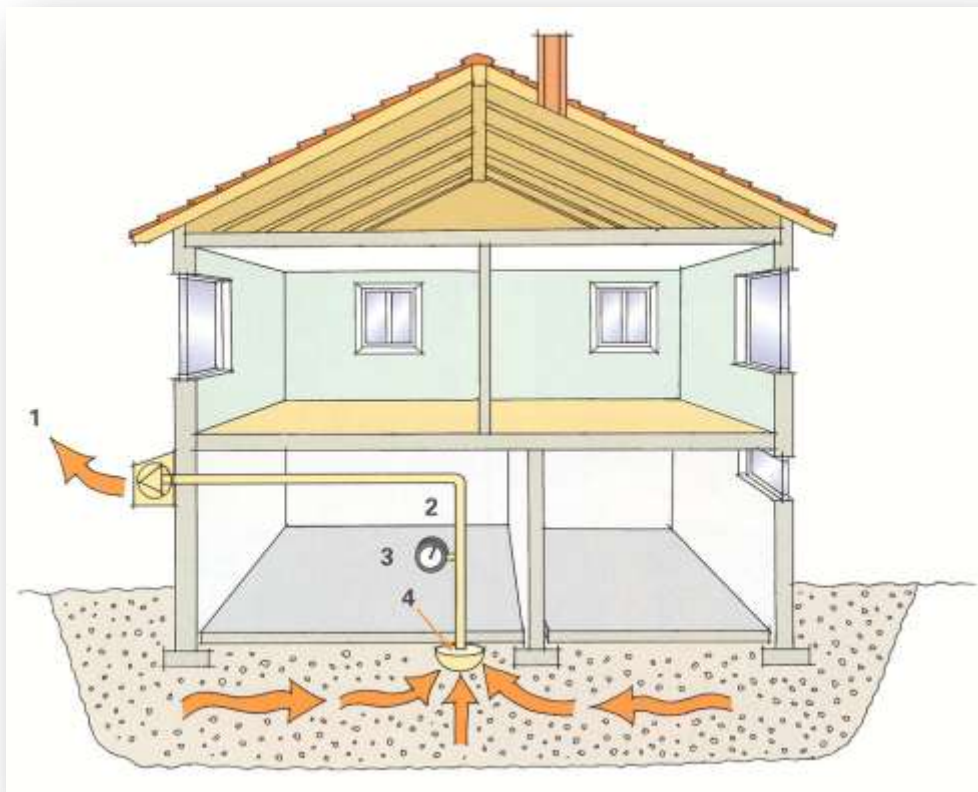


Sealing



Sealing of leakage points in basement floor

Sub-slab depressurization



1. Fan placed outside or near outer wall
2. PP-plastic pipe 70 mm diameter.
3. Manometer for control of pressure difference.
4. Cavity about 300 mm radius.

Sub-slab depressurization

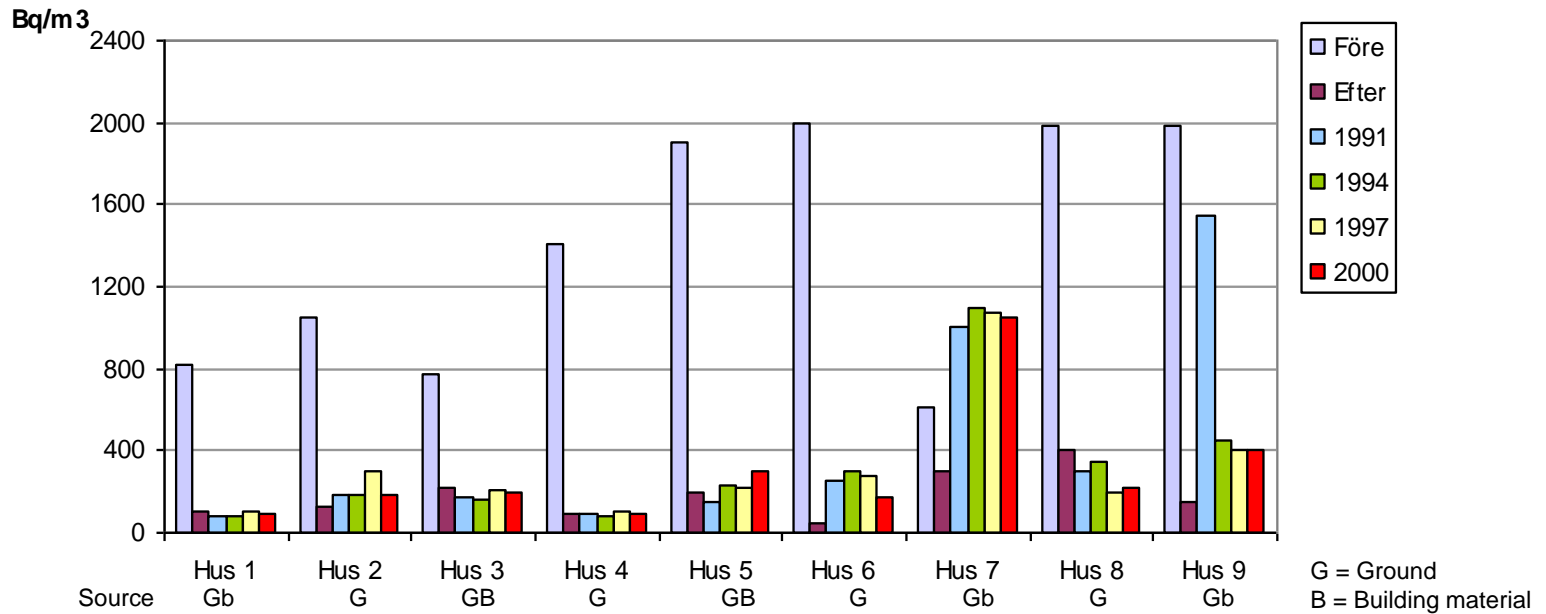


Sub-slab depressurization Uppsala Cathedral

New waterpipes for fire sprinklers was installed 2011. At the same time a sub-slab depressurization was installed.

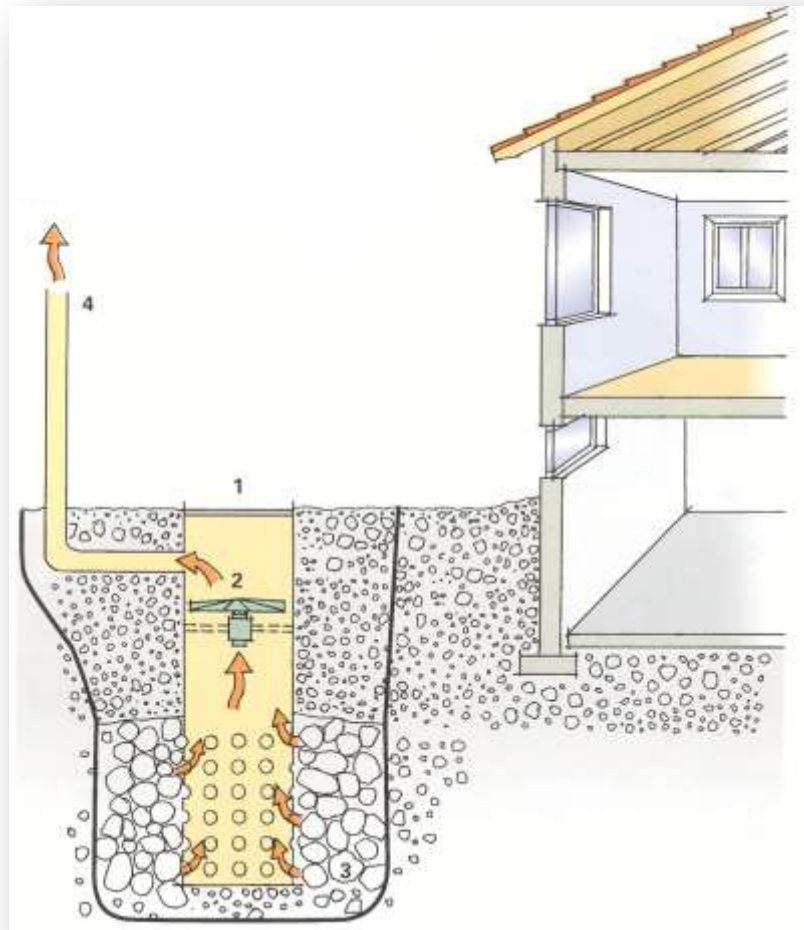


Sub-slab depressurization



Installation of sub-slab depressurization

Radon well



1. Well 40-100 cm diameter and 3,5-4,0 m deep.
2. Fan and eventually silencer.
3. Depressurized chamber.
4. Pipe for exhaust air.

Radon well



Uppsala Cathedral & Uppsala Castle



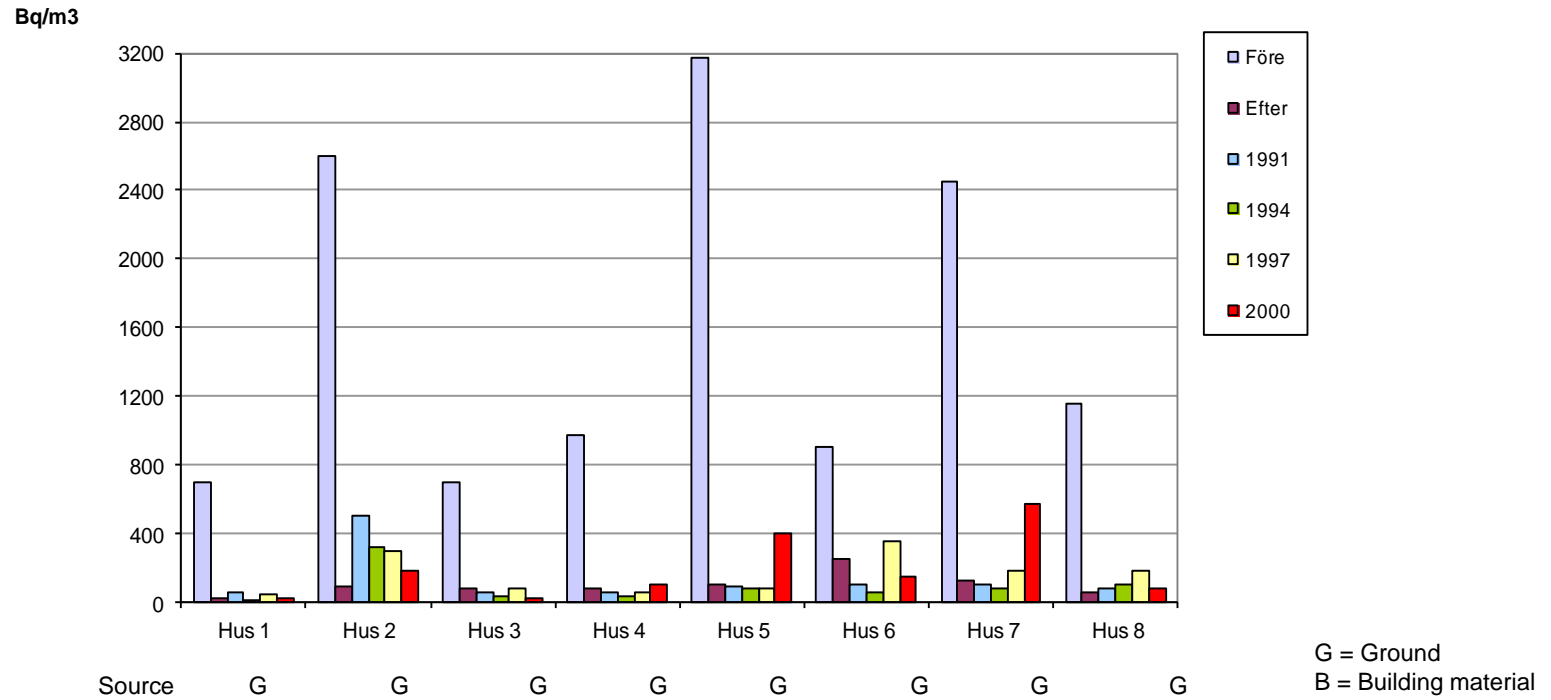
Radon well installation



Royal Castle, Stockholm



Radon well



Installation of radon well

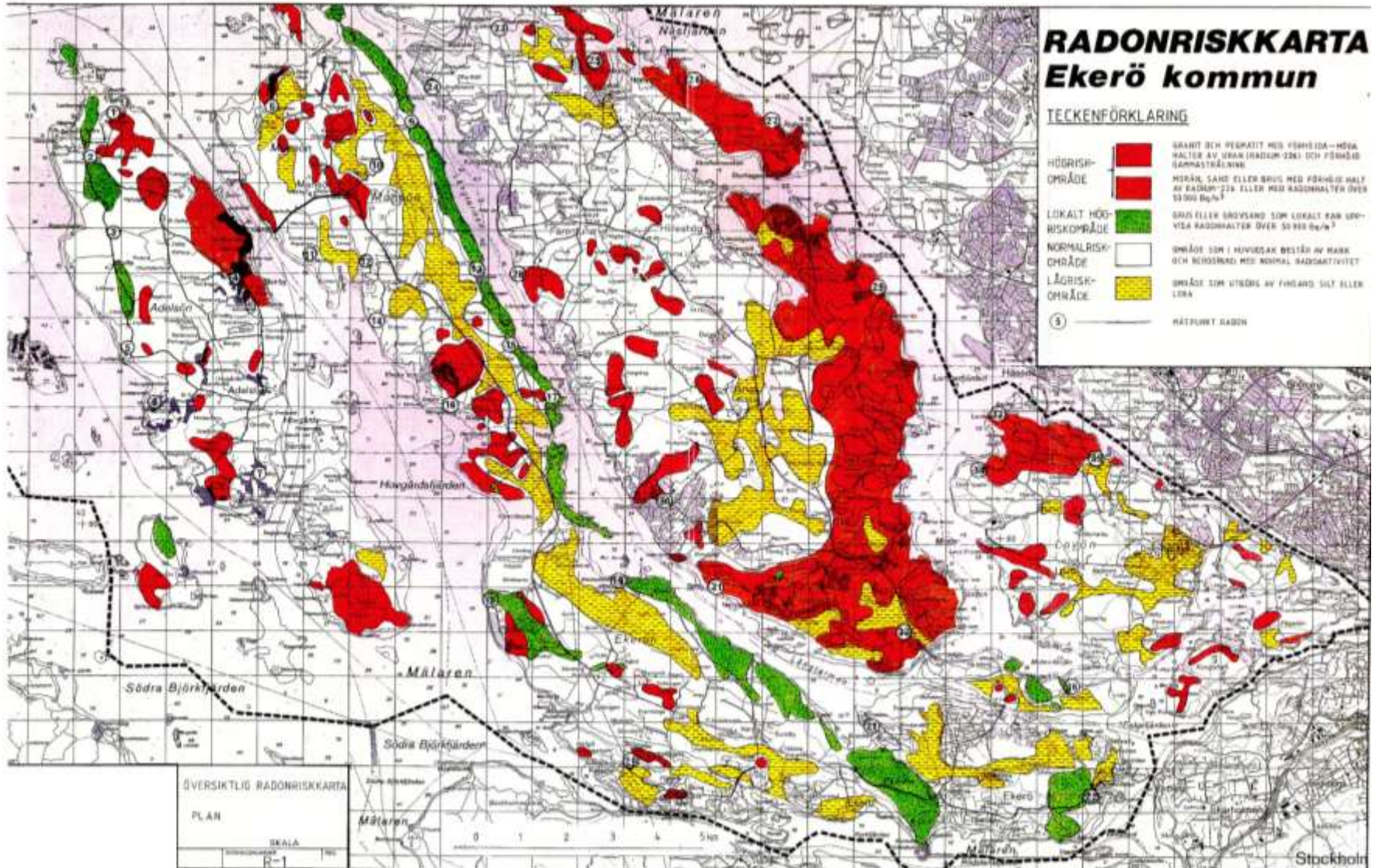
New buildings prior to construction

Radon levels in soil air

Gamma radiation from bedrock



Radon risk map



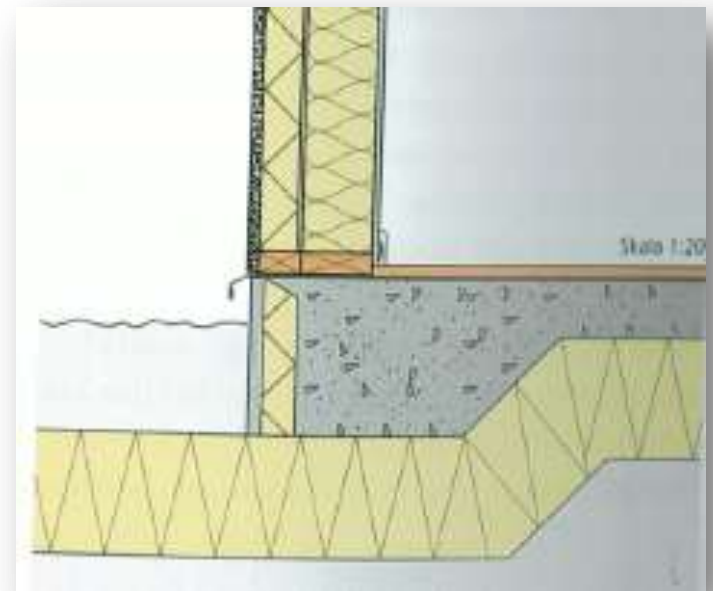
Risk assessment

From the results of the investigation a risk assessment is made

- Radon protected construction
- Radon safe construction

Concrete slab on the ground

- Concrete slab of radon proof design – sealed pipe penetrations etc.
- Airtight insulation on slab edge.
- Possibly sealing layer.
- Thicker double reinforced concrete slab
- Possibly drainage pipes beneath slab



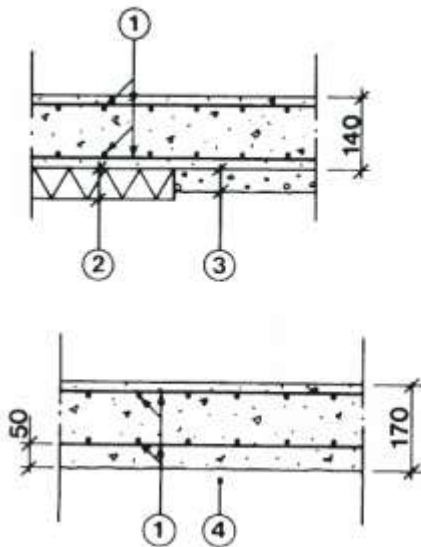
New buildings prior to construction

Prevention actions

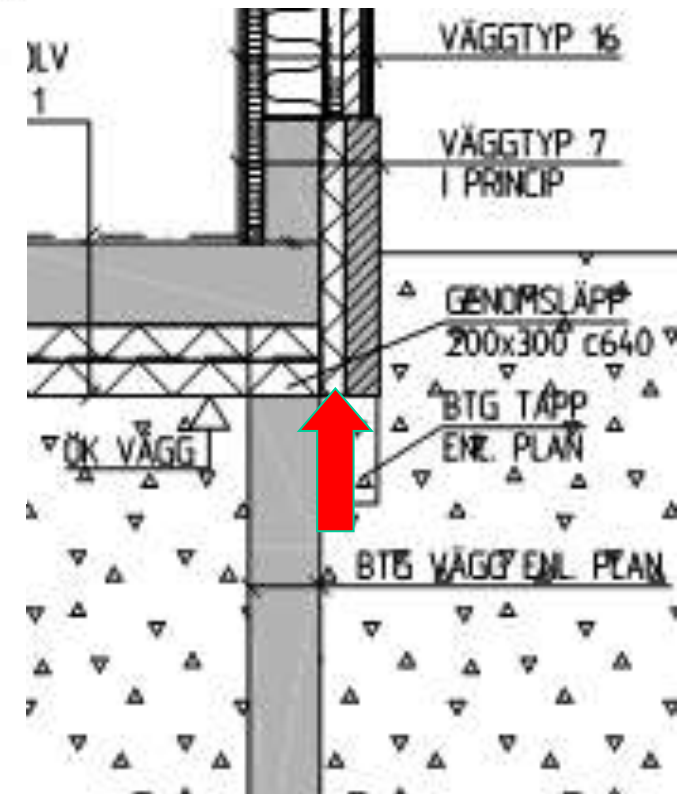
- Prevent building from settlement as much as possible
- Mechanical supply & exhaust air ventilation system
- Inform supervisors & construction workers
- Check on the production

New buildings prior to construction

Radon safe concrete construction



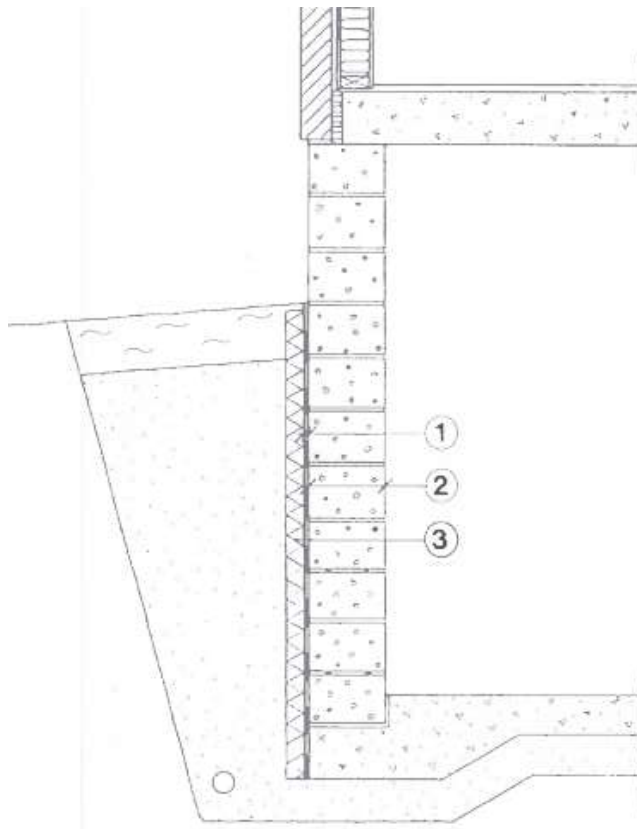
1. Rutarmering
Nps 50 Φ 6 c/c 100 eller
Ks 40 Φ 8 c/c 150
2. Mineralullsskiva
3. Arbetsdäck
4. Undergrund eller uppfyllnad



An radon safe slab is 40-50 % more expensive than a conventional slab

New buildings prior to construction

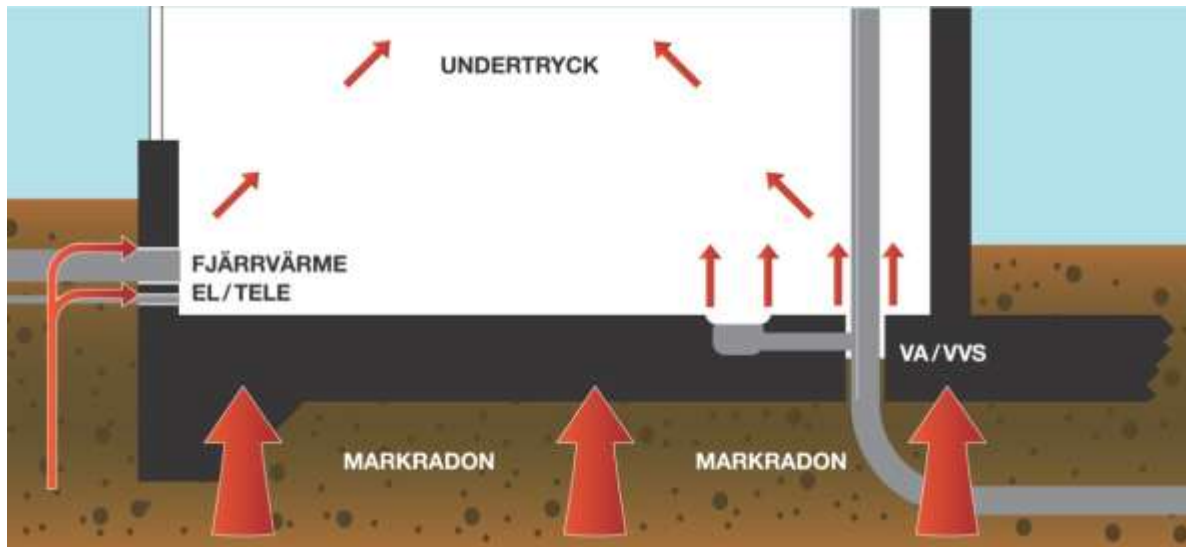
Basement outer wall of blocks



1. Sealing of cracks
2. Wall of lightweight concrete, lightweight-aggregate concrete or hollow concrete blocks.
3. Gas and moisture barrier extended to the bottom of the concrete slab.

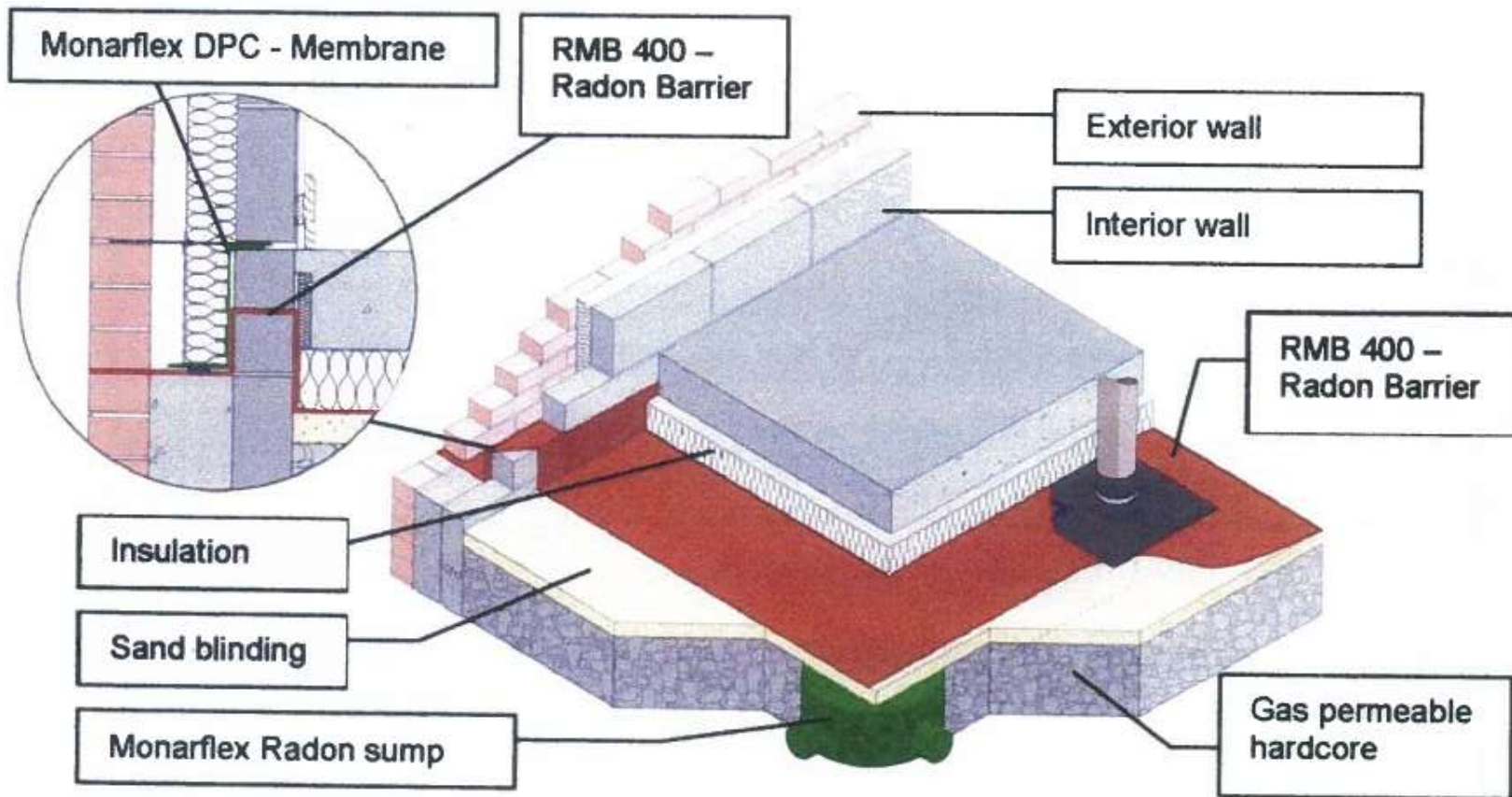
New buildings prior to construction

Sealing of penetrations with Radona R802



New buildings prior to construction

Monarflex sealing layer



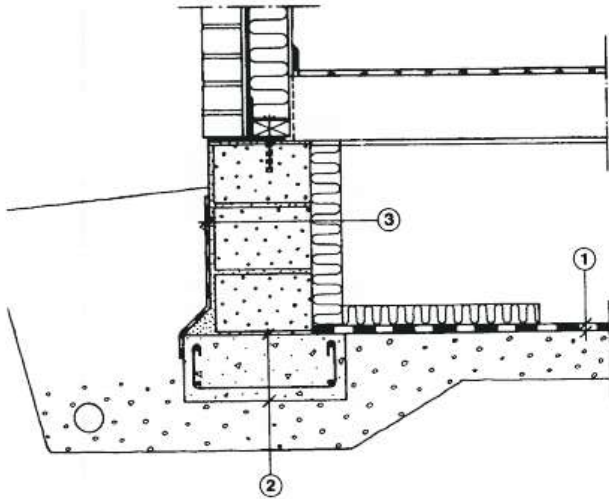
Crawl space

- Soil surface with sealing layer
- Exhaust air pipe up above roof (passive or active)
- Crawl space ventilated by indoor air
- Ventilation under a sealing layer



New buildings prior to construction

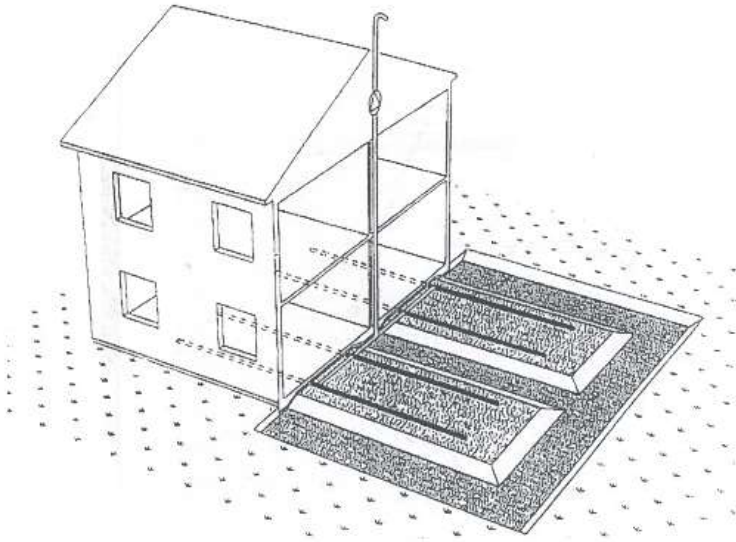
Crawl space is ventilated with indoor air



1. Sealing layer of 0,2 mm plastic foil or 0,4 mm reinforced PE-membrane
2. Footing with floated surface and cast so that it is radon tight. Thickness and reinforcement to suit the soil
3. Bitumen felt

New buildings prior to construction

Drainage pipes beneath concrete slab



- Drain pipes at least 2 m from slab edge.
- Drain pipe ends is sealed.
- Drain pipes converges at one point and connect to a vertical duct.
- If necessary a fan is connected the vertical duct.

If the concrete slab is radon safe the distance between pipes can be up to 10 meters.

New buildings prior to construction

Preventive actions

- ❖ Sealing of expansion joints
- ❖ Level Differences between building parts
- ❖ Cast fittings
- ❖ Concreting of higher building parts e.g. a high wall

Remember!

An preventive action that works passive is safer and cheaper over time then an active action demanding fans.

Documentation is important so succéidén owners understands how the action is supposed to function.

New buildings prior to construction

Green Building (Sweden Green Building Council)

Classification of buildings in 3 levels & includes e.g. radon.

Class	Residential & premises for common use	Other local buildings
• Bronze	101 – 200 Bq/m ³	101 – 200 Bq/m ³
• Silver	51 – 100 Bq/m ³	51 – 100 Bq/m ³
• Gold	≤ 50 Bq/m ³	≤ 50 Bq/m ³



Arkitekter Ingenjörer

Thank you!

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