Radon in Norway
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Content
- International risk estimates
- Radon in the present Norwegian housing stock
- Radon sources
- Outdoor radon concentrations in some areas
- National radon working group
- Development of a new strategy

International risk estimates
Recent studies have confirmed that radon, also at low levels, poses a risk for lung cancer.

The dose-response relation seems to be linear with no evidence of a threshold, and a significant risk remains even when the measured radon concentrations are below the present action level in Norway (200 Bq/m³).

Pooled analyses from 13 European case-control studies, Darby et al. 2005.
7148 cases and 14208 controls
3662 cases and 4966 controls

Darby et al. 2005
Estimated that radon is the cause of
- 2% of all fatal cancer incidents in Europa
- 9% of all fatal lung cancer incidents in Europa

Based on a mean radon concentration in European dwellings of 59 Bq/m³.

Estimation:
About 280 fatal lung cancers in Norway yearly.

Average number of deaths yearly for some causes in the 1996-2005 period (Statistics Norway) is given in the table.

| Natural disasters (avalanches etc.) | 33 |
| Fire | 58 |
| Drowning | 74 |
| Car accidents | 329 |

Radon in the present Norwegian housing stock
Norway is divided into 19 counties and 431 municipalities.
Nearly 200 municipalities have carried out radon surveys.
Radon in the present Norwegian housing stock

- The populations weighted annual mean radon concentration is estimated to 88 Bq/m³.
- It has been estimated that 9% of the housing stock (175,000 dwellings) has an annual mean radon concentration exceeding 200 Bq/m³ and that 3.3% of the housing stock has an annual mean radon concentration exceeding 400 Bq/m³.
- 8,000 out of the expected 175,000 dwellings with radon concentration above 200 Bq/m³ have been identified so far.

Radon sources

- Areas with large occurrence of alum shale.
- Potentially high concentrations of radon

The indoor radon concentrations in Norway are among the highest in Europe because:

- High occurrences of radium rich soil and bedrock,
- High occurrences of highly permeable unconsolidated sediments,
- Household water from borehole wells
- Construction of buildings
- Climate

- In Norway about 12% of the dwelling are supplied with water from private borehole wells
- For about 10% of the wells the recommended action level of 500 Bq/l is exceeded
- Rule of thumb: 1000 Bq/l in household water is causing 100 Bq/m³ in the indoor air radon concentration (shower, dish washer, washing machine)

Large occurrences of highly permeable unconsolidated sediments

Examples of dwellings exceeding 10,000 Bq/m³ (maximum 56,000 Bq/m³) and outdoor concentrations exceeding 200 Bq/m³ (Sundal et al. 2007)

Building construction highly permeable clay aggregates blocks in the foundation construction
Outdoor radon concentrations

- In 1996-1997 an indoor radon concentration measuring project was carried out in the Ullensvang municipality.
- In a particular area in the municipality, 90 % of the dwellings had radon concentrations exceeding 200 Bq/m³.
- Mitigation measures did not have the expected effect in all cases.
- Some outdoor measurements were carried out.
- The finding of radon concentrations exceeding 200 Bq/m³ were leading to more measurements in some well known radon affected areas and some reference areas.

Outdoor radon

WHO:
The outdoor radon concentration varies normally between 5 and 15 Bq/m³.
Recognizing there is a need to be more aware of radon risks within the relevant Norwegian authorities, and recognizing there is a need to coordinate the radon work between the different ministries and directorates, the Ministry of Health and Care Services appointed a working group autumn 2007.

The mandate is very wide:
- Health risk
- Land planning
- Building constructions
- Schools
- Kindergartens
- Workplaces (ordinary and underground)
- Household water
- Information and risk communication
- State contribution to mitigation of dwellings

The report will be finished autumn 2008.
- Nordic recommendations will be published soon
- The report from the WHO International Radon Project is also expected soon

Norwegian Radiation Protection Authority is focusing on the principle of ALARA (As Low As Reasonable Achievable)

Because:
- No threshold
- Majority of the lung cancer cases are caused by exposure to radon concentrations below 200 Bq/m³

- All new building should be built radon-tight and preferably also with systems for depressuration of the ground.
- Measures taken during building construction can significantly reduce radon.
- Radon – a subject when buying and selling homes.
- Information and education
Radon in Norway
state and strategy

Radon safe area!