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Recommendations for radon in dwellings in the Nordic countries

Introduction

There is strong direct evidence that long-term exposure to radon increases the risk of lung cancer. This has been verified in many epidemiological studies in dwellings and of uranium miners. The International Agency for Cancer Research, IARC, has classified radon as a human carcinogen (the highest classification) together with, among other agents, tobacco smoking and X- and gamma radiation. Recently performed pooled analyses from Europe and North America have confirmed that radon, down to low levels, poses a risk for lung cancer.

The estimated number of annual lung cancer deaths attributed to radon exposure in dwellings in the Nordic countries is almost 1 300 per year. This is more than 10 percent of the total number of lung cancers in the Nordic countries. Most of the lung cancer cases occur at radon levels under the recommended action levels. Almost two thirds (63 percent) of the lung cancer deaths attributed to radon occur among people exposed to less than 200 Bq/m³.

Radon levels in dwellings in the Nordic countries, except for Iceland, are high, in Finland, Norway and Sweden among the highest in the world. This fact makes it particularly important to identify dwellings with high radon concentrations and take remedial measures in these dwellings.

In Sweden the estimated number of dwellings exceeding the national action level (200 Bq/m³) is about 450 000. In Finland more than 200 000 dwellings have radon levels exceeding 200 Bq/m³ and 60 000 of these have levels above the national action level of 400 Bq/m³. In Denmark about 65 000 dwellings have radon concentrations above the recommended action level for simple improvements (200 Bq/m³) and 5 000 dwellings above the recommended action level for more effective improvements (400 Bq/m³). In Norway an estimated number of 170 000 dwellings have radon levels above 200 Bq/m³. Measurements carried out in dwellings in Iceland indicate low levels of radon and it is estimated that no dwellings in Iceland have radon levels above 200 Bq/m³ due to the Icelandic bedrock being primarily composed of basalt.

Calculations show that if all dwellings with radon concentrations exceeding 200 Bq/m³ in the Nordic countries had the radon levels reduced to 100 Bq/m³, 360 lung cancer deaths could be avoided each year.

It is also commendable to make efforts to reduce radon levels in dwellings in the Nordic countries even when the level is below 100 Bq/m³. If the long-term average of population exposure to radon in the Nordic countries were reduced by 10 percent about 130 lung cancer cases could be avoided annually.

Preventing radon in new dwellings

For new dwellings the reference level should be in the range 100 - 200 Bq/m³, aiming at an average level less than 50 Bq/m³. National, regional and local authorities should promote an adequate surveillance of radon levels in new dwellings.

The most cost-effective way to reduce the average radon level, in a long-time perspective, is to assure that the radon concentrations in all new buildings are low. New buildings should therefore be planned and constructed in such a way that the annual average radon concentration will be as low as reasonably achievable, in accordance with national building codes.

Reducing radon levels in existing dwellings

The reference level for radon in existing dwellings should be in the range 100 – 200 Bq/m³. Remedial measures should be promoted with the aim of bringing the radon level in the indoor air down as low as reasonably achievable, preferably below 100 Bq/m³. Radon remediation should be undertaken with cost-effective, well documented and validated methods.

The national and local authorities are responsible to find effective ways to identify dwellings at risk. This could be done via surveys, campaigns and in connection with transactions when buying and selling homes.

All homeowners should be encouraged to measure radon in their homes. Local authorities should provide information about radon and how to reduce radon levels.

Measurements

Decisions for remedial measures should be based on long-term measurements; the duration should be at least two months during the heating season. Measurement systems should be calibrated regularly and the standards used should be traceable to international standards.

Preferably measurements should be performed by accredited laboratories. Also measurements of radon concentrations in household water should be performed with calibrated equipment and traceable to international standards.

Education and training

Education and training of all personnel working with radon issues is important to ensure correct information and guidance is given to the general public about radon and successful prevention and remediation.

Training courses should be available for:

Personnel working with radon measurements and radon remediation

Officials working with radon in national, regional and local authorities

Building professionals

Risk communication

It is recommended that the national authorities provide regional and local authorities with information material on radon in dwellings that could be distributed to the general public.

To communicate the risk from radon exposure to the general public is a challenging task, because one cannot see, smell or taste radon. Experience from many countries has shown that local communication efforts are the most effective. Radon campaigns at a national level have in several countries turned out to be less effective.

Most of the radon-induced lung cancer cases occur among smokers. Smoking increases the lung cancer risk by a factor of 25, and therefore the total risk is especially high when influence of smoking and radon are combined. For smokers the greatest reduction in risk is obtained if they both stop smoking and reduce the radon concentration. Therefore efforts should be made to spread this information to the population. However, experience from the US shows that mixing radon and stop smoking messages can lead to optimistic bias by non-smokers causing them to discount or underestimate the radon risk.