Measurement of Radon in dwelling, workplaces and mines – impact of new legislation in Europe

Dr. Mikko Faarinen, Eurofins Radon

ECOLOGICAL AND HEALTH RISK ASSESSMENT

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1-minute background

Radon is known to cause problems for miners already in 18th centaury.

1940s through 1970s renewed problems due to Uranium mining.

The individual studies did not conclusively show correlation between cancer and Radon.

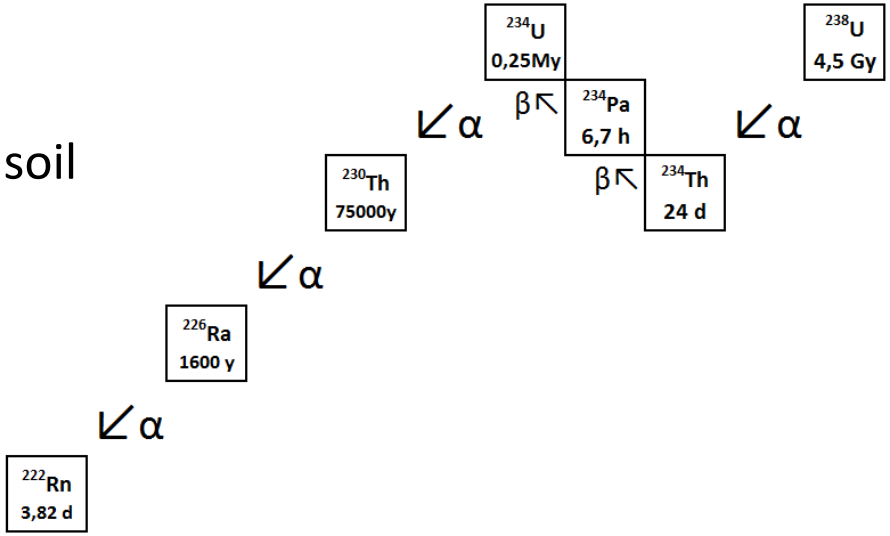
RADON-EMANATIONSAPPARAT. «*Genom att dricka emanationshaltigt vatten tillföres den mänskliga organismen radiumemanation. Radiumemanationen kommer till blodbanan och faller sönder i sina omvandlingselement under utsöndring av alphastrålar, som utöva ett häftigt bombardemang på blodkropparna….*» Detta står att läsa i beskrivningen av apparaten.

Radon is produced in Uranium prone areas

Radon is a noble gas which will diffuse from soil into dwellings

Radon has a half-life of 3,82 days

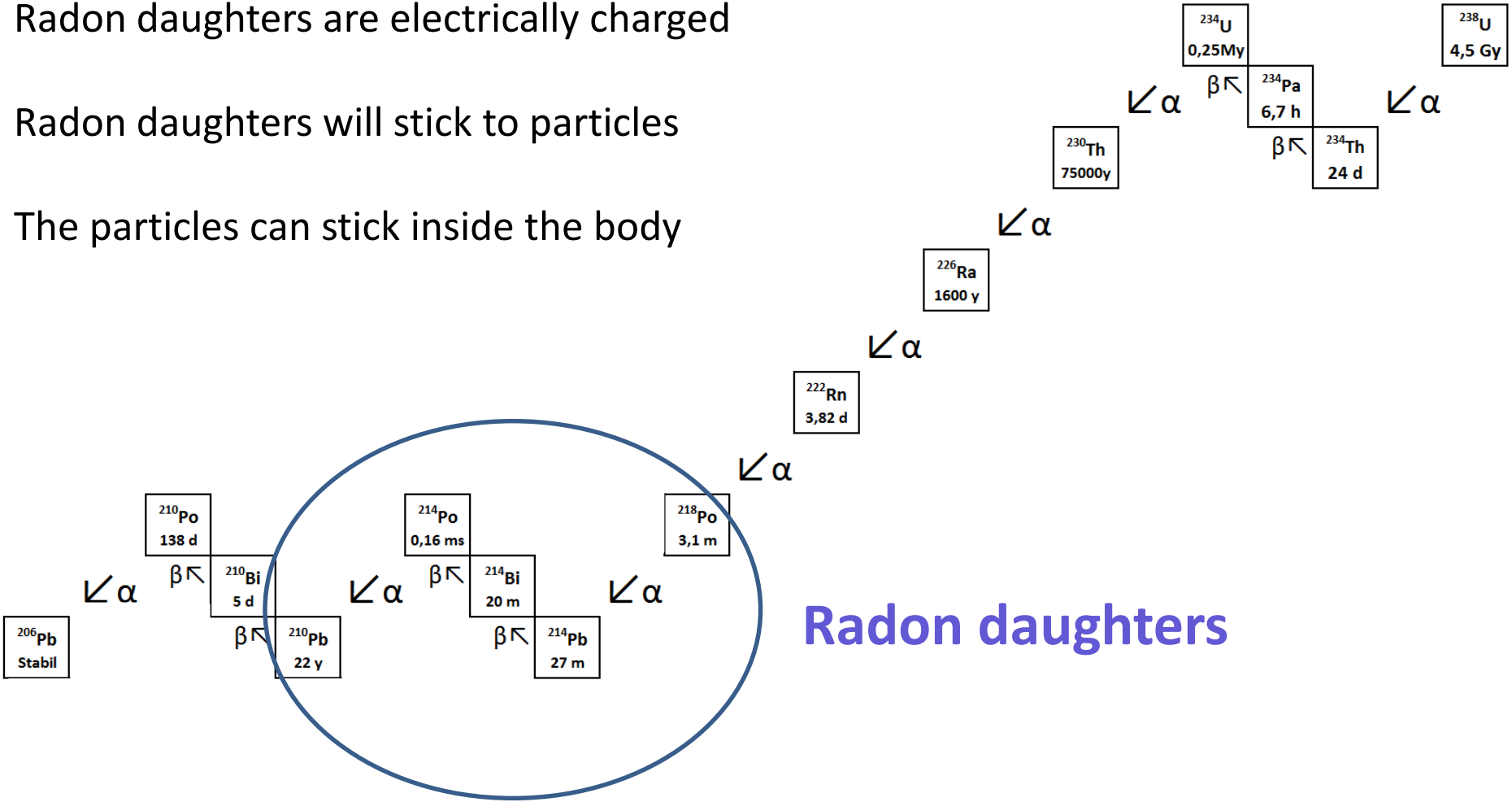
Radon in itself is fairly harmless



Radon daughters are electrically charged

Radon daughters will stick to particles

The particles can stick inside the body



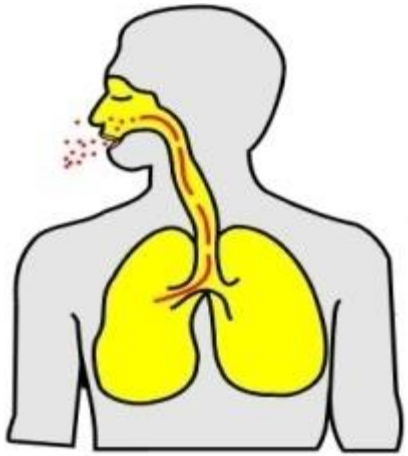
Radon daughters

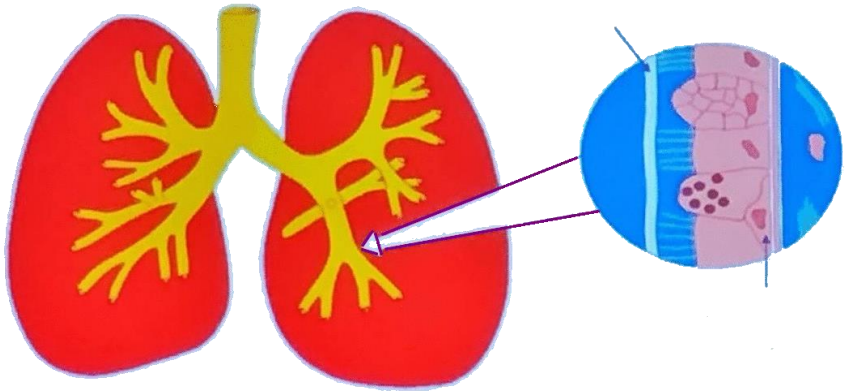
Cause for lung cancer

Radon 2nd most common cause for lung cancer

300 000 cases per year in EU.

Alpha particles have short range, (approx. 50 µm) all energy is deposited in the lungs.





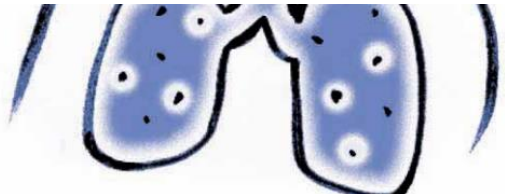
Graphic: Z. Daraktechieva.

Background

Article 54

Radon in workplaces

1. Member States shall establish national reference levels for indoor radon concentrations in workplaces. The reference level for the annual average activity concentration in air shall not be higher than 300 Bq m^{-3}, unless it is warranted by national prevailing circumstances.



Nationell handlingsplan

Strål säkerhets myndigheten
Swedish Radiation Safety Authority

Folkhälsomyndigheten

Boverket

Livsmedelsverket

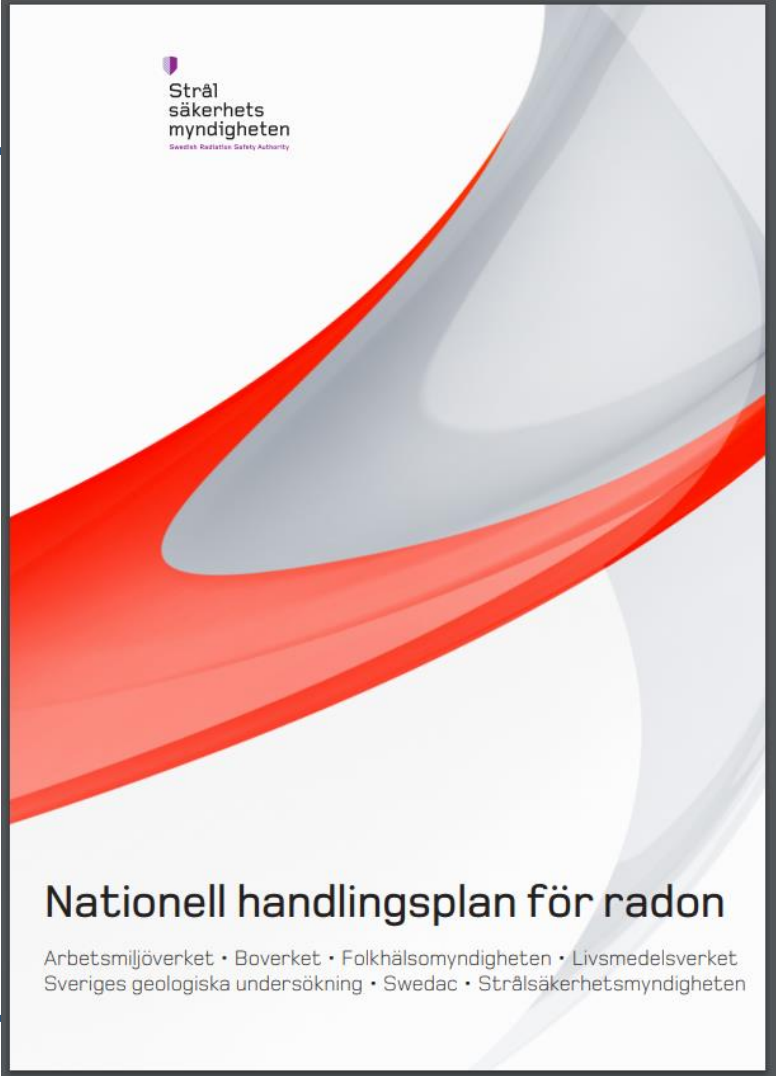
SGU
Sveriges geologiska undersökning

ARBETSMILJÖ VERKET

SWEDAC

Länsstyrelserna

Sveriges Kommuner och Landsting



SWEDAC

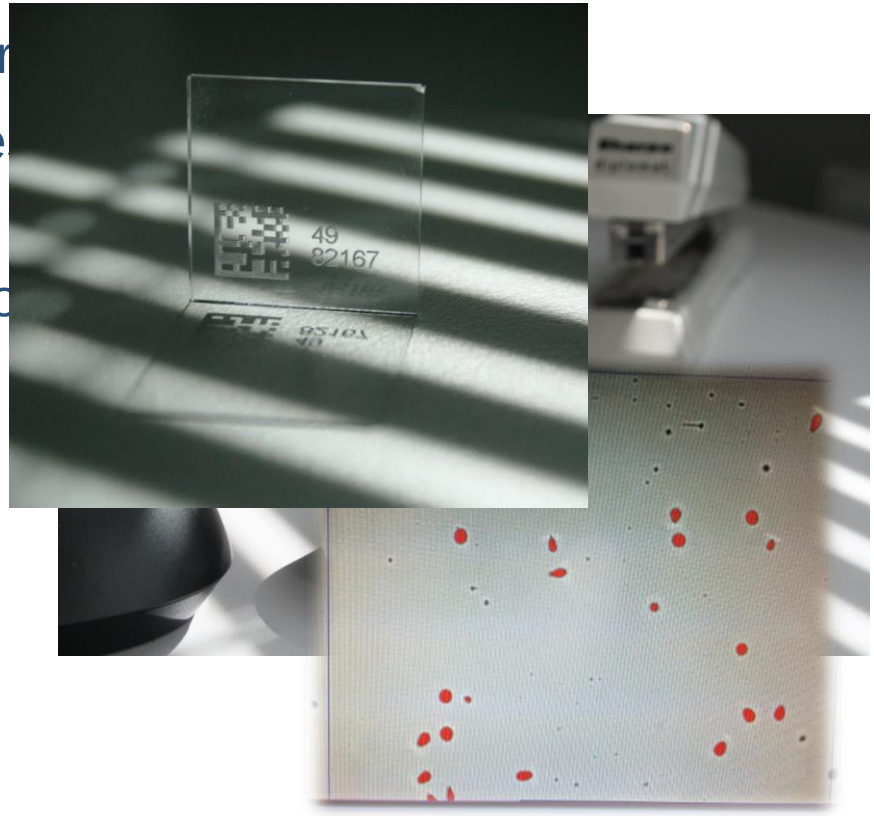
- Revision of certifications and accreditation
- Accreditation body for Radon laboratories
  - reviews that routines exist and are followed
  - deviation management
  - complete management systems
  - mandatory interlaboratory comparisons (blind test)
- ISO 17025 – for the laboratory
- ISO 11665 – for the measurement standard

Etch track Radon detector

- Integrating passive detector
- Exact results for long term measurements
- Inexpensive
- Simple
- Preferred measurement method for determining radon content
- Suitable for large quantity of measurements
- International standard **ISO 11665 – 4**

Radon detector

- Only Radon gas enters the detector
- When Radon decays, the α-particle will damage the film
- The film is developed and number of tracks measured
- Exposure time is known → Radon level is calculated



Many workplaces to check

In 2016, the EU's business economy was made up of almost 27 million active enterprises with some 150 million persons employed.

Radon underground

- Emitted directly from the walls
- Dissolved in water, Radon can transport long distances
- ^{220}Rn (Thoron) can give rise to doses
- Has its own legislation

Picture: Radonspa Bad Gastein

Radon exposure at workplaces

200 Bq / m^3	Reference level in Sweden
0,36 MBq h/m^{3}year	Allowed dose for non-underground workers. Comparable with 200 Bq/m^3 with work time 1800 h.
0,72 MBq h/m^{3}year	Underground work in permanent workplaces. Comparable with 400 Bq/m^3 with work time 1800 h.
2,1 MBq h/m^{3}year	Underground work in mines, tunnels or construction work under ground. Comparable with 1300 Bq/m^3 with work time 1600 h

ARBETSMILJÖ VERKET

Hygieniska gränsvärden (AFS 2018:1)

Underground mines

At 0,72 MBq h/m^3year it is necessary to know individual doses.

Etch track detectors are carried by all workers underground.

The detector is individual, hence a dose can be calculated.

Underground mines

$D_{work} = D_{tot} – D_{freetime}$

D_{work} reported to authorities

D_{tot} is measure by etch track detector

$D_{freetime}$ measured in e.g. dressing room

Underground mines

$D_{work} = D_{tot} – D_{freetime}$

Challenges:

Large number of people

Large number of contractors

High variation of Radon levels

Dirty working conditions

Low respect for measurements

Actions at high levels

If D_{work} high, what then:

Where has the detector been stored

Check levels with direct measurements

Affected personnel is kept over ground

Areas are restricted or sealed of

Ventilation increased

Water removed

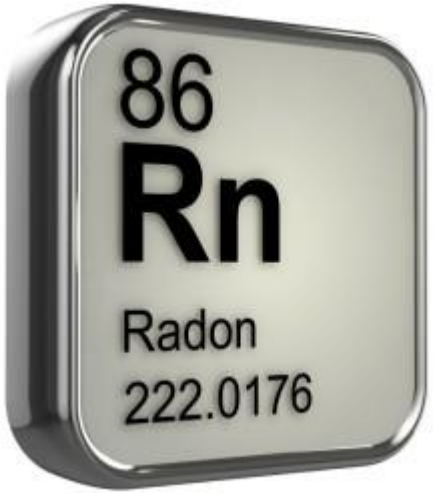
Conclusions

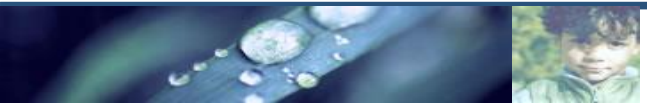
New legislation is/coming in place.

Expect a large number of Radon measurements.

Measure Radon in both dwellings, workplaces and especially underground.

Use a accredited laboratory ISO 11665.





Tack!

Mikko Faarinen, Ph. D.

mikkofaarinen@eurofins.se

+46 70 – 321 86 42