



# From mapping of radon in soil to inventory of radon indoors - The Swedish Story -

**21/09/2021 Monika Nordqvist**

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# 1. Presentation

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**Background in natural science specialized in mathematics and physics**

**Business Unit Manager at Eurofins Radon Testing Sweden**

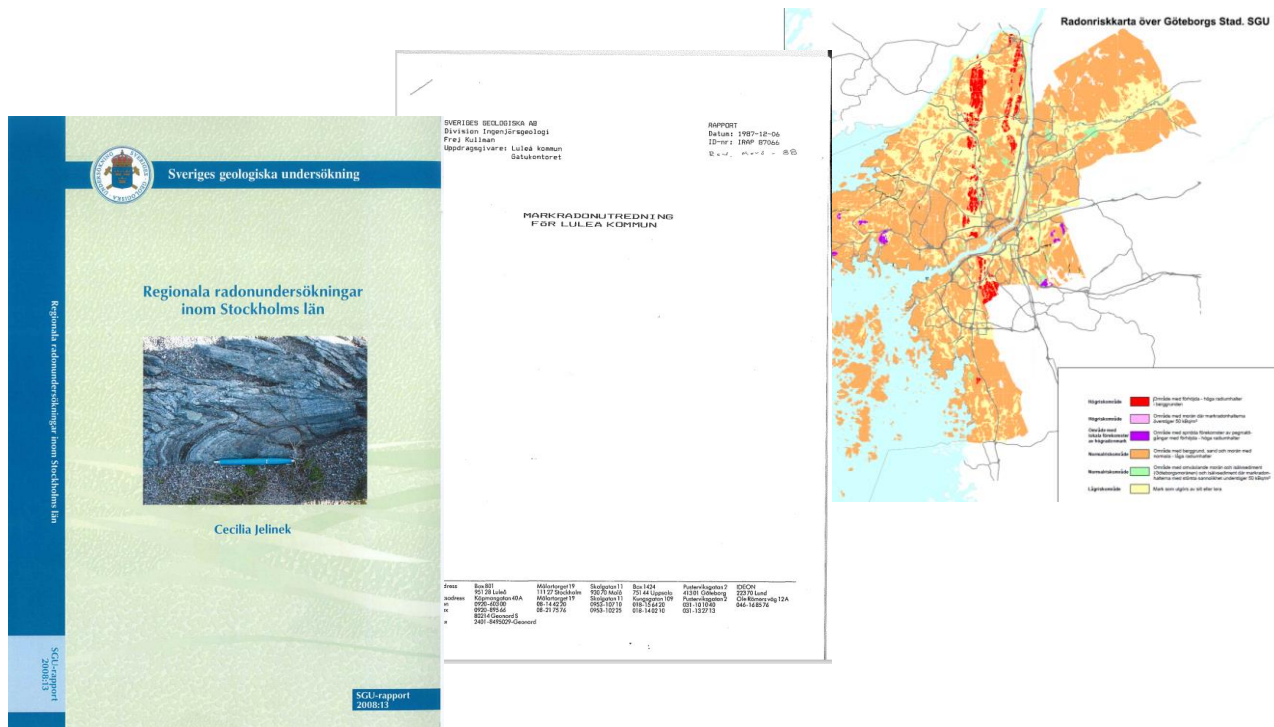
**Global Competence Center for Radon**

- **Board member of The Swedish Radon Association**
- **Chairman of IRMA (International Radon Measurement Association)**
- **Active in radon for over 7 years**



# 2. Mapping radon in soil

Sweden have a long history of measuring radon and produce Radonrisk mapping



The composite image displays three related documents:

- Book Cover:** "Regionala radonundersökningar inom Stockholms län" by Cecilia Jelínek, published by Sveriges geologiska undersökning (SGU).
- Report Page:** "RADONUTREDNING FÖR LILLEÅ KOMMUN" by Sveriges geologiska undersökning, dated 1987-12-06.
- Radon Risk Map:** "Radonriskkarta över Göteborgs Stad. SGU", showing radon risk levels in Göteborg, Sweden, with a legend for risk categories.

**Legend for Radon Risk Map:**

- Högstrålningsområde:** Område med förhöjd- till högst strålningsnivåer
- Högstrålningsområde:** Område med mycket eller mycket höga strålningsnivåer
- Områden med ökad strålningsnivåer i byggnader:** Område med förhöjd- till mycket höga strålningsnivåer
- Radonriskområde:** Område med högstrålningsnivåer som innebär ett stort radonproblem
- Radonriskområde:** Område med strålningsnivåer som innebär ett radonproblem
- Lågstrålningsområde:** Område med strålningsnivåer som innebär ett radonproblem

**Table from Report Page:**

Enhet	Sam 801	Mittstrålningsområde	Radonriskområde	Sam 1414	Radonriskområde	ÖÖÖH
Enhet	91 21 Luleå	11 07 Stockholm	92 26 Åre	10 44 Skövde	41 01 Göteborg	22 01 Lund
Adress	9105-01000-01A	9105-01000-017	9202-01010	1002-01010	4101-01010	2201-01010
nr	9105-01000-01A	9105-01000-017	9202-01010	1002-01010	4101-01010	2201-01010
nr	9105-01000-01A	9105-01000-017	9202-01010	1002-01010	4101-01010	2201-01010



## 2.2 Radon in soil

Radon-222 is formed upon decomposition of radium-226.

The risk of soil radon from a soil type is determined by:

- how high the content of radium-226 is in the bedrock
- how much of all formed radon is emitted to the air in the pores
- how easily the soil air type can be transported - permeability



All homes with ground contact run the risk of getting high Rn levels indoors.

The risk is greater for high Rn levels indoors if the level of radon in the ground air is high – the soil plays an important role

- Higher risk also occurs if ground air volume is large - risk construction
- Concrete slab lower risk but need to be pressure tested.

- **High Rn risk soil area**  
Level of radon in the soil air is  $>50$  kBq/m<sup>3</sup>
- **Normal Rn risk soil area**  
Level of radon in the soil air is 10-50 kBq/m<sup>3</sup>
- **Low Rn risk soil area**  
Level of radon in the soil air is  $<10$  kBq/m<sup>3</sup>  
Also soils with low permeability, eg clay and silt



## 2.4 Conclusions

### Recommended methodology for further action after mapping

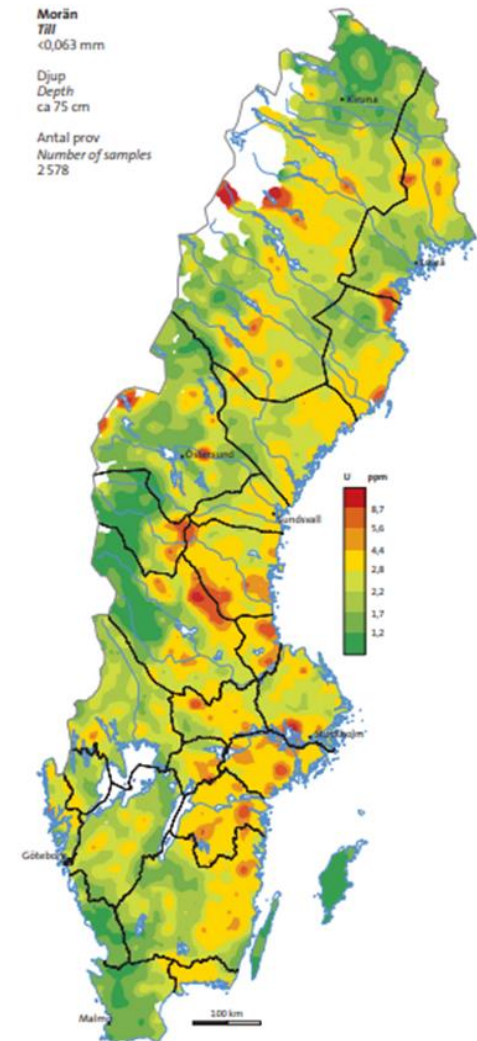
1. Measure level of Rn in buildings with blue concrete as building material
2. Measure building within high risk soil areas
  - especially buildings with basements
  - buildings created on ice river material or gravel
  - buildings created directly on bedrock or blasted rock fillings
3. Prioritize buildings where people are staying permanently like dwellings, apartment buildings and workplaces





## 2.5 Risks with mapping

- Mapping of radon in soil is a good start but also shows an overall plan in which areas there is a risk of high radon levels
- Always measure radon in soil before start construction of a new building – it's cheap and easy to use
- Radon maps are never a reliable tool for determining the indoor environment
- The only way to get a reliable picture of the radon level in indoor air is to measure
- Swedish Radiation Authorities prefer to analyze for Rn indoors by an oriented passive detector with CR-39 technology. It's cheap and easy to use.

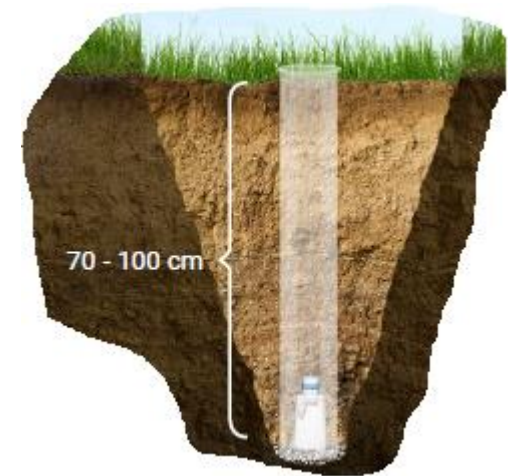


### 3. Measure radon in soil with ROAC

Measure radon in soil with ROAC method – preferred and used on the soil radon investigation from Luleå Municipality 1988

- Uses active charcoal for detect Rn in soil air
- Measure time from 4-7 days
- Fast reliable answers
- 10 000's of test performed all over the world
- This analys of Rn in soil is applicable by the "risk classifications"

Eurofins are at the moment developing an revolutionary product to measure radon in soil air. Release of that analyse will be during Q2 2022.



## 4. Swedish history of measure Rn indoors

Sweden have method descriptions used for several decades for perform measurement of Rn in indoor air for:

- Dwellings
- Apartment building
- Workplaces

Sweden have a high competence in the Rn area both from the authorities and from the commercial side.

This is the reason Eurofins has their **GLOBAL COMPETENCE CENTER** for radon in Sweden

After the EU-Directive 2013/59/EURATOM Sweden have a Radiation Protection Law for Rn level on workplaces, established 2018

The Swedish Radiation Protection Law prefer the Rn Track Etch method and are currently working on updating the method description for workplaces

## 5. The method "Rn track – etch"

Proposed method globally for measure radon in indoor air is an orientated passive measurement with CR-39 technology (called track etch method) because it is so cost effective and easy to use

Eurofins, as one of the biggest laboratories all around the world, has over 30 years of experience with this analyze and performed over 2 million tests

Eurofins, as their former owner, were a part of the the origin of the analyze and have participated to develop the method over the years. Today Swedish national guidelines as well as international guidelines exist for workplaces through IRMA and more international guidelines will come

## 6. To know Rn level – measure

- The whole world agrees – to know your level of Rn inside buildings you need to measure
- 2013/59/EURATOM determines that all EU countries must develop an action plan to ensure that the level of Rn does not exceed 300 Bq / m<sup>3</sup> for all employees on workplaces
- The most cost effective and easiest way to measure is by Rn Track Etch method
- Use an accredited partner that proves its good quality and independence





# eurofins

**Eurofins has the FASTEST ANALYZE TIME IN EUROPE on the accredited Rn Track-Etch analyzes.**

**Welcome to our exhibition where we tell you everything about our:**

- **Digital revolution and our current digital platforms for the analyze**
- **Existing guidelines and method descriptions for Rn measurement**
  - **Shares our over 30 years of knowledge in the area**