EIGHTH INTERNATIONAL CONFERENCE
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Continuous measurements of indoor radon concentration with CR-39 detectors in two thermal spas - a case study

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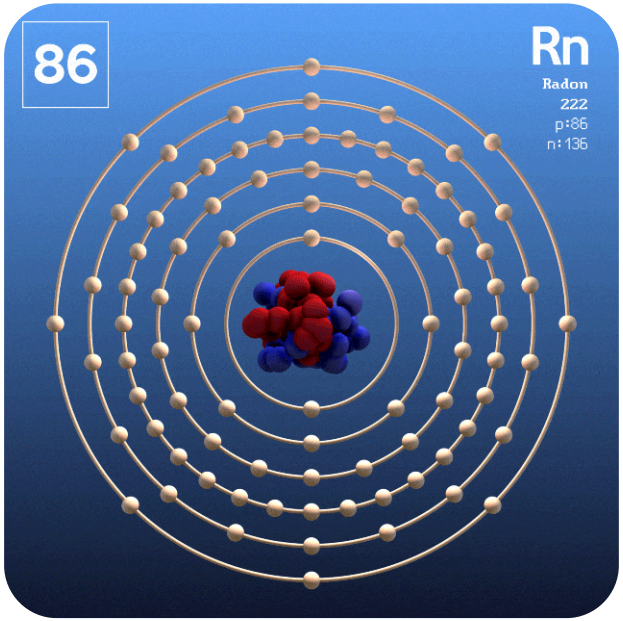
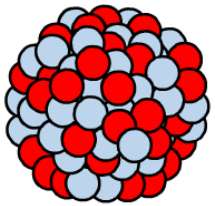
1. Introduction

- Radon (^{222}Rn) is a colourless, odourless, tasteless radioactive gas, which may be found in indoor environments such as caves, homes, schools, and workplaces.



1. Introduction

- It is produced from the natural radioactive decay of uranium (^{238}U), which is found in several types of soils and rocks such as granite and volcanic ones.

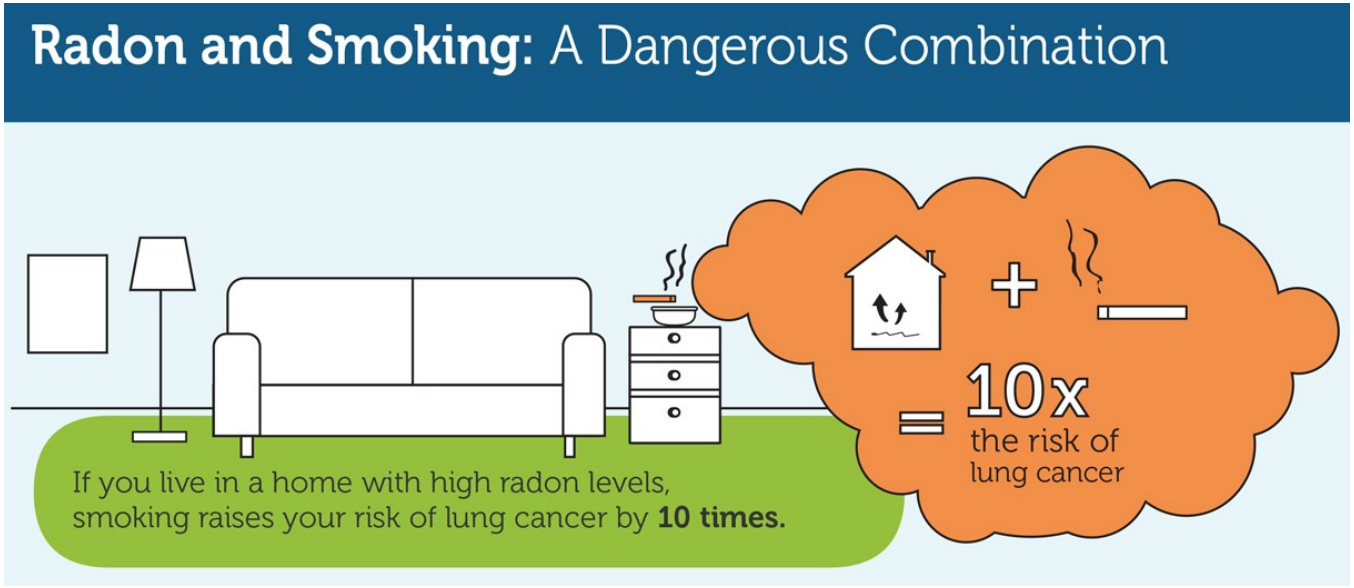


$^{226}_{88}Ra$

- In Portugal, the geological settings are mostly comprised of granite rocks with uranium mineralization, which represents a potential risk for the exposure to high indoor radon levels, particularly in some specific regions.

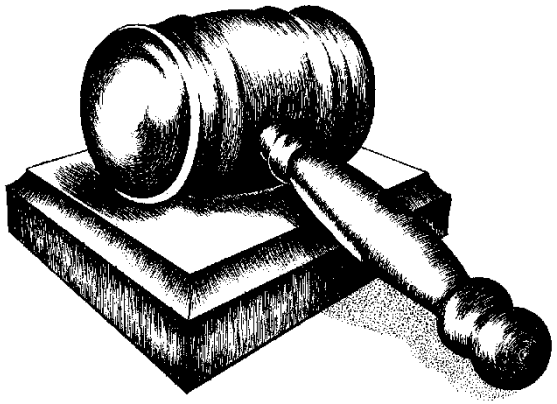
1. Introduction

- It is estimated that radon causes between 3–14% of all lung cancers in a country, depending on the average radon level and the smoking prevalence in a country (UNSCEAR, 2000; OMS, 2007).



1. Introduction

- The Decree-Law 108/2018, of December 3, which transposes into national law the EURATOM Directive 2013/59 of December 5, 2013, establishes the legal regime for radiological protection, setting the rules safety precautions for protection against the dangers arising from exposure to ionizing radiation (Euratom, 2013).



2. Objective

- Evaluate of radon concentration in indoor air in therapy rooms and technical areas of Portuguese thermal spa.

3. Materials and Methods

- Radon measurements were carried out by using CR-39 radon detectors during approximately 12 months covering continuous periods.

3. Materials and Methods

Thermal Spa "A"

Winter
21/12/2018 to 15/04/2019
(113 days)

Spring/Summer
15-04-2019 to 26/08/2019
(102 days)

3. Materials and Methods

Thermal Spa "A"








4. Results

Radon concentration in indoor air (Bq/m^3)

Place	Winter	Spring/Summer
Thermal Spa	344	305
ORL	1283	1941
Vichy shower	801	1175
Nozzle shower	1649	1310
Bertholet	1747	1133
Double cabin	415	366
Spa pool	437	383
reception	313	280

4. Results

- 94% (17/18) of the indoor air radon concentration values of spa A do not comply with Portuguese legislation (300 Bq/m^3)
- That 100% of the sites do not comply with WHO recommendations for radon concentration in indoor air (100 Bq/m^3).

4. Results

- Concentrations within the thermal spa vary widely, with a minimum of 280 Bq/m^3 and a maximum of 1941 Bq/m^3

- In Bertholet (application of the heat and thermal steam in the vertebral region), nozzle shower, vichy shower and ORL spaces the indoor air radon concentrations are higher than the other spaces.

5. Conclusions

- The explanation for these results is due to the fact that in these places there is the use of natural mineral water, where radon is also present (Silva et al., 2017; Silva t al., 2016; Silva et al., 2015; Silva, 2015).

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