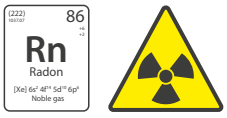
Ventilation solutions for the mitigation of radon gas build up

Hazards, reference regulations and strategies

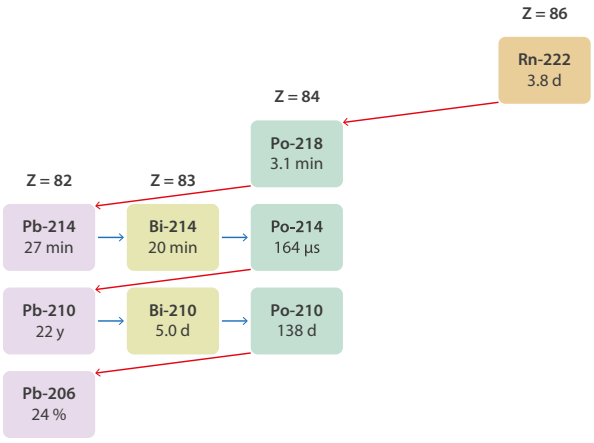


RADON GAS

VENTILATION SOLUTIONS FOR THE MITIGATION OF RADON GAS BUILD UP

What is radon?

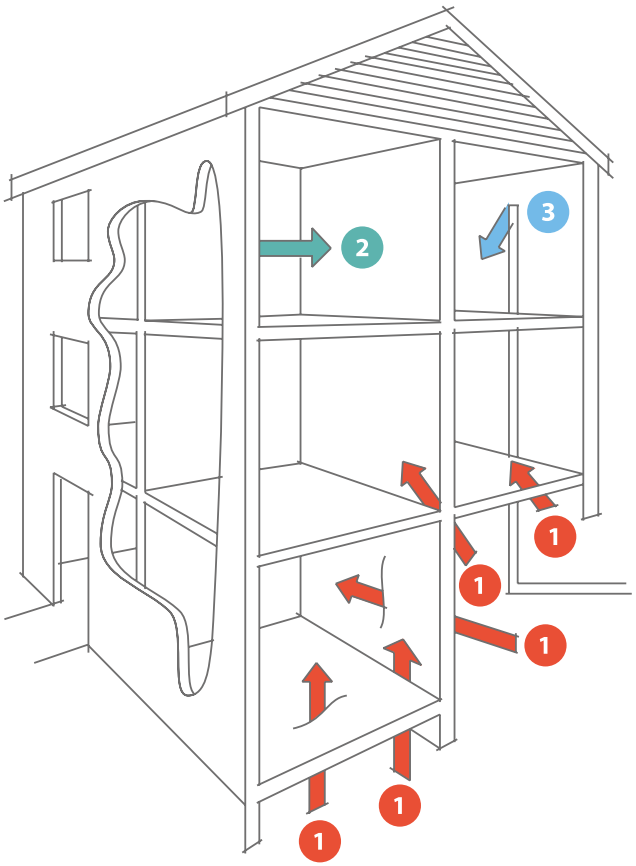
Radon is a radioactive gas of natural origin that is produced from the decay of Uranium (^{238}U) and Radium (^{226}Ra). This decay to more stable elements called "radon isotopes" results in the emission of **high energy alpha particles capable of damaging our DNA** and causing mutations and tumours.



Radon tends to concentrate in underground spaces with a low ceiling and significantly contributes to the amount of ionizing radiation the general population is exposed to.

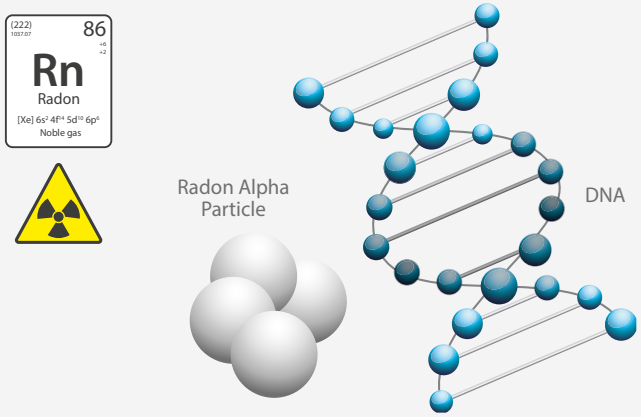
How does it reach us?

Radon gas can reach us through **seepage from granite soils** (generally) and, to a lesser extent, by its presence in water and some construction materials.



1. **From the soil.** Through cracks and fissures, construction joints or cavities, conduits or utility lines.
2. **From the construction materials.**
3. **Through water.**

This radon decay results in the emission of high energy alpha particles capable of damaging our DNA and causing mutations and tumours.



*According to WHO, **up to 14% of lung cancer cases** are caused by exposure to radon gas*

Hazards to health

The World Health Organisation (WHO) estimates that **as much as 14% of lung cancer cases around the world are attributed to exposure to radon gas**, making it the second root cause behind tobacco.

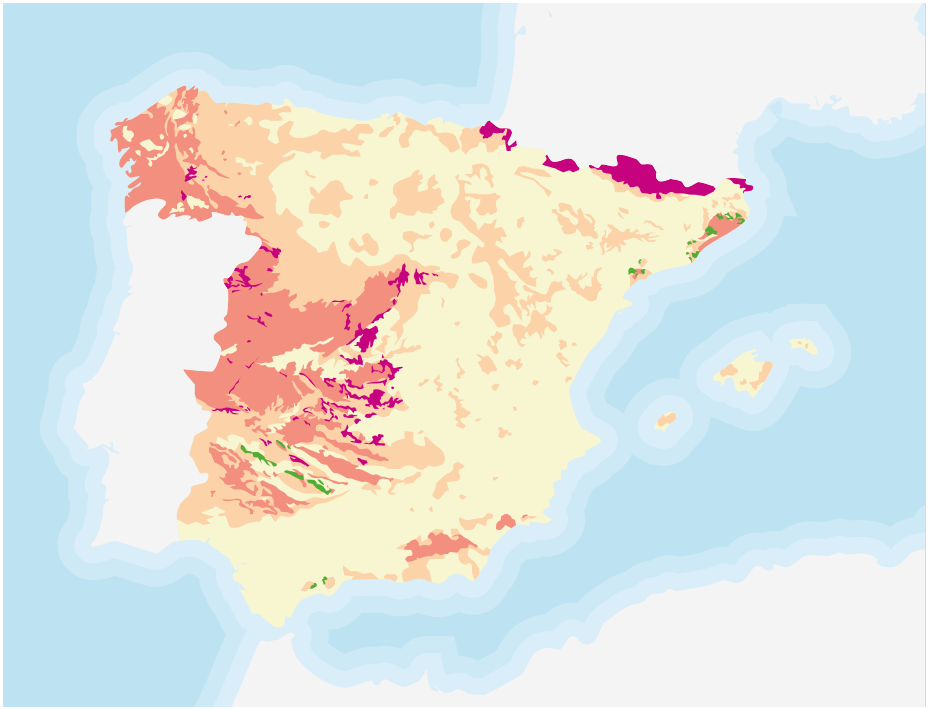
Also, this organisation estimates that the probability of suffering this type of cancer increases tenfold in people that are also smokers.

Lung cancer is the second type of tumour most diagnosed in the world. According to data from the Global Cancer Observatory, in the year 2020 more than two million cases were diagnosed around the world.

In Spain, the Ministry of Health calculates that exposure to radon gas is responsible for 4% of lung cancer deaths, reaching as much as 25% in some regions such as Galicia.

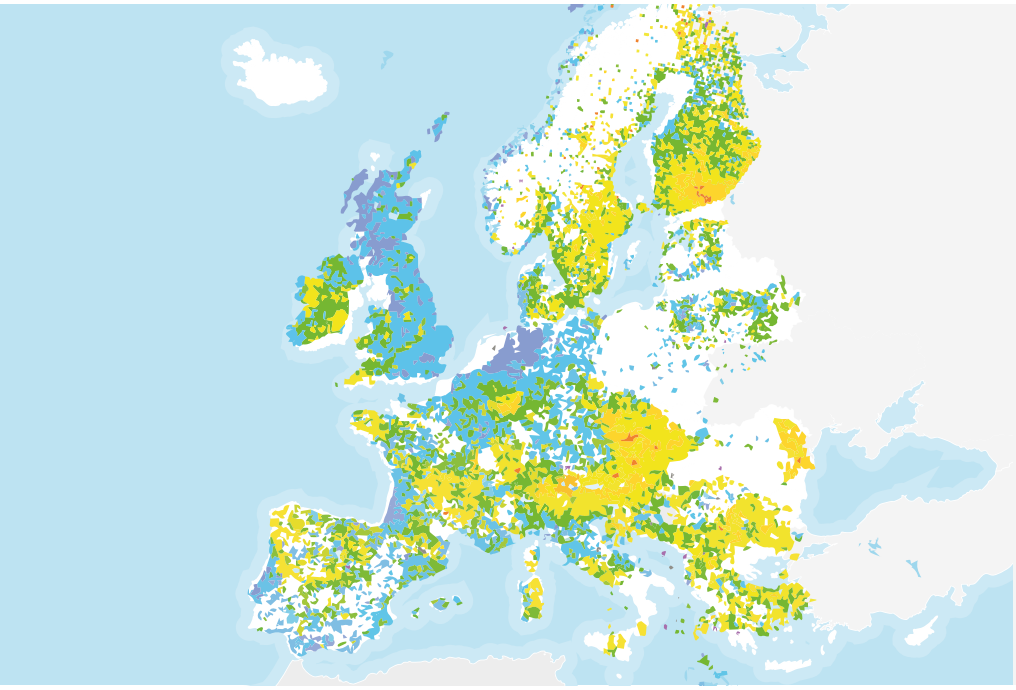
A global problem

Granite soils are one of the most common substrates in the world, and therefore the risk of high concentrations of radon gas from occurring is a global problem.



Map of the radon potential in Spain. January 2017

Source: Nuclear Safety Council (Consejo de Seguridad Nuclear- CSN)



European Indoor Radon Map. November 2021

Source: European Commission. DG. JRC, REM 2021

REGULATIONS OF REFERENCE

COUNCIL DIRECTIVE 2013/59/EURATOM, laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation.

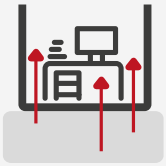
This European Directive establishes the reference levels for radon concentrations indoors and for gamma radiation indoors emitted by construction materials and introduces requirements for recycling waste originating from industries that process radioactive materials of natural origin and transform them into construction materials.

In existing exposure situations involving **exposure to radon**, the reference levels shall be set in terms of concentration of radon activity in the air, as specified in Article 74 for the general public and Article 54 for workers.

Article 54

Radon at the workplace

Member States shall set the national reference levels for radon concentrations indoors at the workplace. The reference level for the annual average concentration of activity in the air must not exceed **300 Bq/m^3**, unless it is justified by the prevailing national circumstances.



Member States shall require radon measurements be carried out:

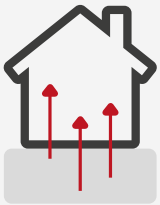
— (a) at workplaces within the areas identified in Article 103, **which are located on the bottom floor or basement**, taking into account the parameters contained in the national action plan in accordance with paragraph 2 of Annex XVIII, as well as

— (b) **at specific workplaces identified in the national action plan**, taking into account paragraph 3 of Annex XVIII.

Article 74

Exposure to radon indoors

Member States shall set the national reference levels for radon concentrations indoors. The reference levels for the annual average concentration of activity in the air must not exceed **300 Bq/m^3**.



Within the framework of the national action plan mentioned in Article 103, member States shall promote actions to identify homes with radon concentrations (as an annual average) exceeding the reference level and, when appropriate through technical or other means, **promote measures to reduce radon concentrations in these homes**.

Member States shall guarantee that local and national information is available on the exposure to radon indoors and the associated health risks, on the importance of carrying out radon measurements and on the **technical means that are available to reduce existing radon concentrations**.

STRATEGIES

Ventilation solutions are often the only alternative

The technical guide drafted by the Instituto de ciencias de la construcción Eduardo Torroja (IETcc) in the year 2019, titled *Rehabilitación frente al radón* (Rehabilitation in the presence of radon), includes the main global radon mitigation strategies.

Currently there are different protection strategies against radon, which are generally focused on radon originating from the soil. Their main objective is to **lessen the exposure to radon of people inside buildings**. Thus, these strategies can be grouped into:

Mitigation strategies **before radon enters** the building

Isolation strategies

Protection barriers. Barriers are considered to prevent radon from entering inside the buildings by improving the water-tightness of the enclosure that is in contact with the soil.

01 **Ventilation strategies inside a containment space**

02 **Ventilation strategies by soil depressurisation.**

Mitigation strategies **after radon has entered** the building

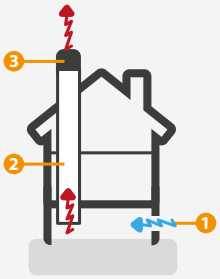
03 **Ventilation strategies of habitable spaces**

In existing buildings, isolation strategies are limited by the presence of pre-existing construction elements, the scope of action, the available economic resources, etc., and therefore the ventilation strategies are often presented as the only alternative.

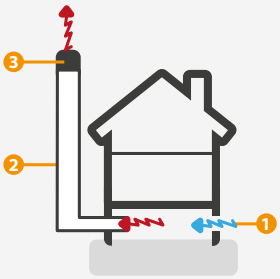
01 Ventilation strategies inside a containment space

The containment space, air chamber or sanitary chamber is a space located between the ground and the spaces to be protected. In this case, it is a place where most of the radon originating from the soil tends to accumulate.

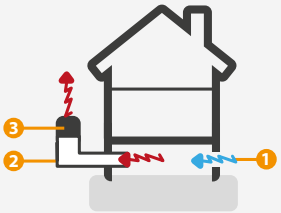
The purpose of ventilating the air chamber that is used as a containment space is to **reduce the concentration of radon** to which habitable spaces are exposed. This is based on the removal of air with high concentrations of radon from the chamber and thus prevent it from penetrating habitable spaces.



Extract duct with extract fan routed inside the building to the roof.



Extract duct with extract fan routed outside the building to the roof.



Extract duct with extract fan routed on the façade outside the building.

1. Intake opening
2. Extract duct
3. Extract equipment

SOLUTIONS

Ventilation solutions by SODECA guarantee maximum efficiency and flexibility is achieved in adapting to the different possible scenarios.

Residential sector

NEOLINEO/EW

Tertiary sector

SVE/PLUS/EW

Industrial sector

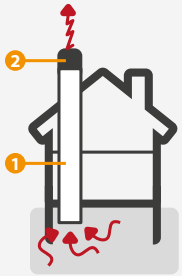
CJBD/EC/AL

EC Technology Solutions

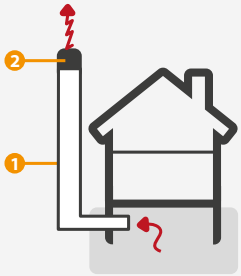
02 Ventilation strategies by soil depressurisation

The purpose of the depressurisation of the ground is to reduce the **concentration of radon that could penetrate through the enclosures** of the building.

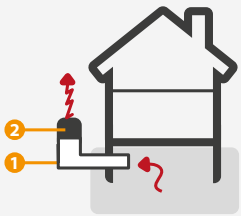
This is based on the depressurisation of the soil that is underlying or adjacent to the building using a mechanical extract fan to remove the radon to the exterior and thus prevent it from penetrating inside the building.



Extract duct with extract fan routed inside the building to the roof.



Extract duct with extract fan routed outside the building to the roof.



Extract duct with extract fan routed on the façade outside the building.

1 Extract duct
2 Extract equipment

SOLUTIONS

Ventilation solutions by SODECA guarantee maximum efficiency and flexibility is achieved in adapting to the different possible scenarios.

Residential sector

NEOLINEO/EW

Tertiary sector

SVE/PLUS/EW

Industrial sector

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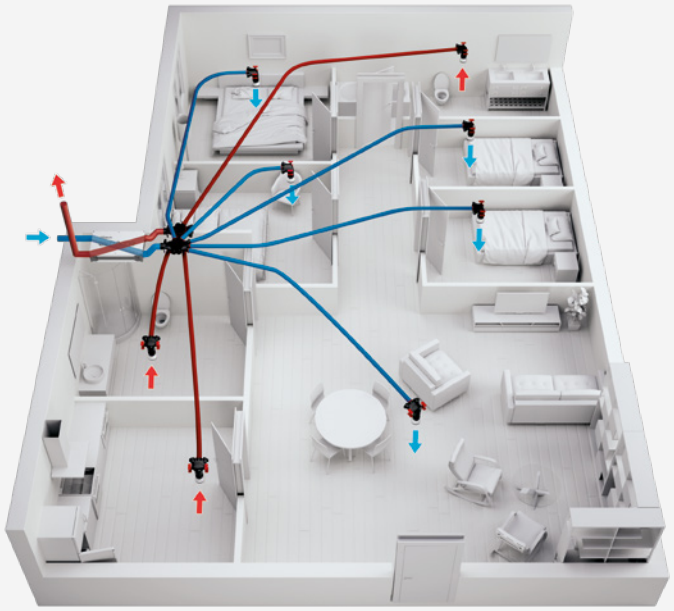
03 Ventilation strategies of habitable spaces



The purpose of ventilation in habitable spaces is to reduce the concentration of radon, by **increasing the renewal of air inside these indoor spaces**.

This is achieved by diluting the concentration of gaseous compounds such radon in the presence of a sufficient amount of clean air.

SOLUTIONS

Ventilation solutions by SODECA guarantee maximum efficiency and flexibility is achieved in adapting to the different possible scenarios.

Residential sector

AIRHOME

Tertiary sector

RECUP/EC-BS

Industrial sector

RECUP/EC-H

EC Technology Solutions

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