Construction techniques and architectural design to reduce the level of radon inside buildings and therefore the risk of cancer

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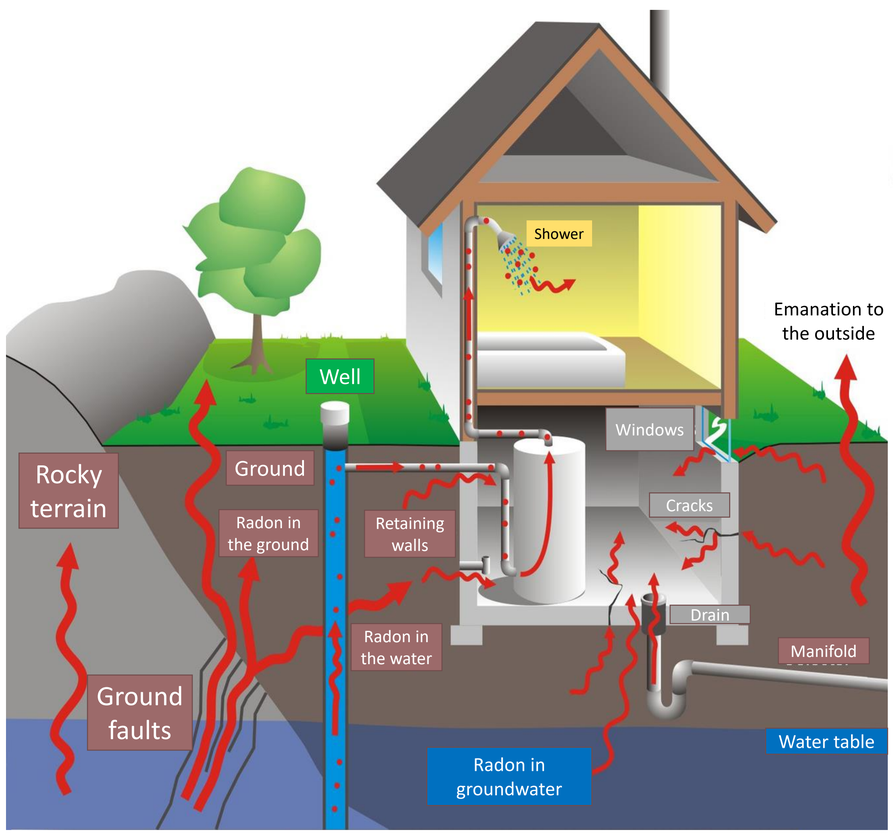
Introduction
Radon is a radioactive gas present in the ground which penetrates into homes through cracks and faults in the ground, fissures in the walls of the building, through water from tanks and pipes, cracks in windows at ground level and through collectors. It accumulates especially in rooms close to the ground. The radiation dose received by radon inhalation inside houses increase considerably the risk of lung cancer. Therefore, it is necessary to design buildings in which the penetration of radon is difficult or prevented and/or its removal is increased.

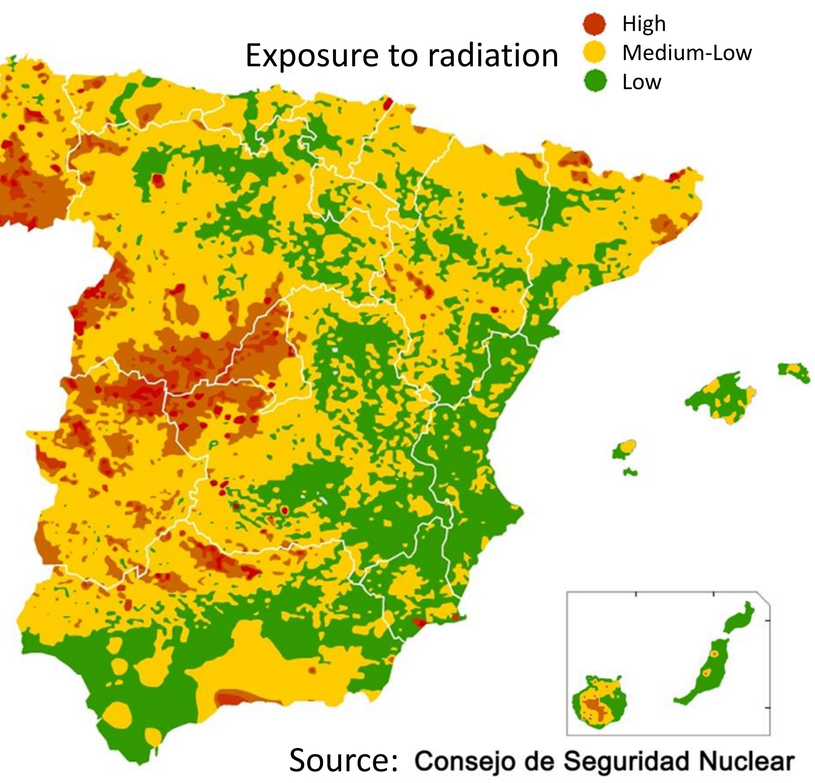
Objectives
The aim of this work is to review the knowledge on cancer risk reduction through the study of the daily radon cycle inside a home and the different techniques used in the attenuation of radon levels inside buildings.

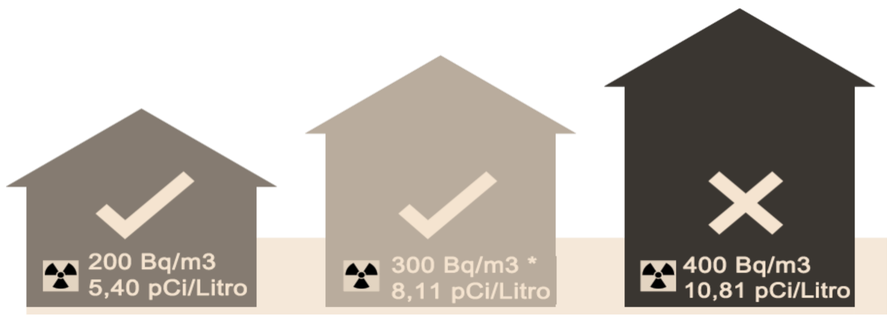
Methods
A multiple bibliographic search has been carried out in databases (Scopus, Pubmed, etc.) considering specialized building and environment journals.

Results
The concentration of radon inside a single-family home varies during the day and night, and with the lifestyle of its inhabitants. During the fall and winter months, with cold outside, people keep doors and windows closed at night; so radon accumulates inside the building. Opening the windows in the morning ventilates the house and the concentration of radioactive gas decreases. During the spring and summer months, with hot days, the general tendency is to ventilate the house at night and keep it closed during the day, thus the cycle is reversed. In general, the highest concentrations of gas are obtained in basements and ground floors and are reduced in second floor. There are different techniques for attenuating the radon concentration. They can be combined to improve results. They are divided into two groups: 1) Anti-radon membranes.- They are made up of several superimposed layers of different materials that complement their characteristics, such as bitumen, polyethylene, aluminum, polystyrene, asphalt multilayers and rubber. They are placed forming a continuous layer in all the construction elements that are in contact with the ground. They prevent the penetration of radon emissions from the subsoil. They can be placed on constructed buildings. They are also combined with crack sealing. Sealing surfaces, joints and cracks in walls and floors, especially in basements, with polymers also prevents the diffusion of radon into the building. Epoxy paints and polyethylene and polyamide polymers are used. 2) Ventilation and depressurization systems.- They capture radon gas in the ground, at the base of the building by means of a depression hood. The gas is extruded to the outside through sealed pipes by means of an extraction system. It has been proven that the incorporation of these systems contributes effectively to reduce radon levels in buildings

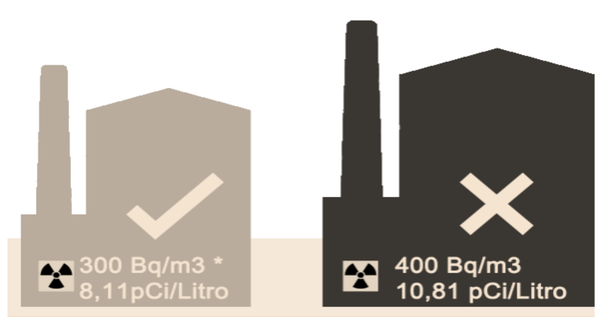
Conclusions
The incorporation of anti-radon membranes and forced ventilation and depressurization systems in buildings contributes to reduce the concentration of radon inside rooms. In this way, the exposure to radiation in its inhabitants is reduced, thus reducing the risk of cancer.



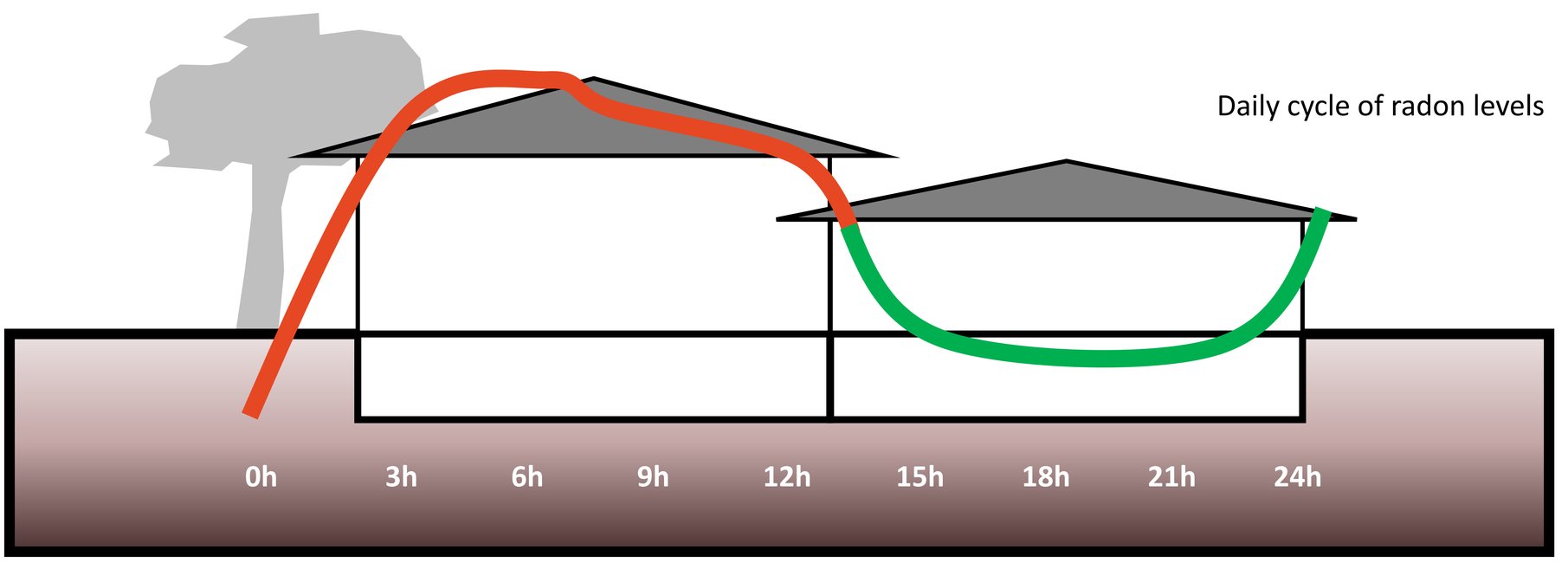




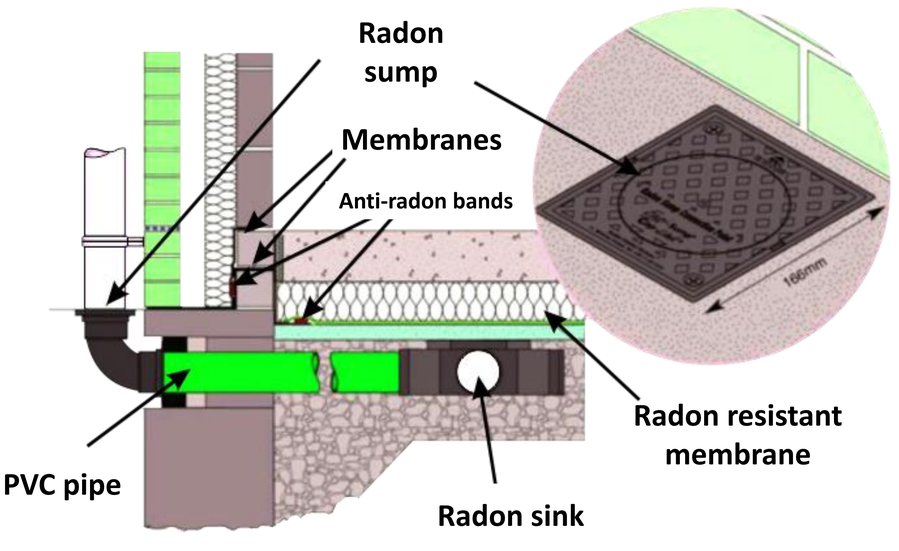
Maximum levels of radon for homes. European legislation



Maximum levels of radon in the industry



Daily cycle of radon levels



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