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Djamil Benghida

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연세대학교
YONSEI UNIVERSITY



주거복지시스템 연구단
Research Group for Housing Welfare System

한국 라돈의 저감 개요

Overview on South Korea Radon Mitigation

○벤기다 자밀*
Benghida, Djamil

Abstract

The purpose of this paper is to describe the real situation of the radon gas in Korea, present governmental actions and analyze some global-techniques that are being implemented for radon gas mitigation in Korea. Radon is a natural occurring radioactive gas, chemically inert, odorless, colorless, flavorless and recognized by the WHO to be the 2nd leading cause of lung cancer after smoking. Strategic actions are being taken in Korea, first by identifying high radon areas in the country correlating actual indoor levels with local soil and housing, second by adapting the legislation especially about preparatory actions, and finally by implementing the measures decided. With effective radon control, Korea's program will succeed in achieving risk reduction goals.

키워드 : 라돈, 실내 공기 품질, 폐암, 실내 라돈 완화

Keywords : Radon, Indoor air quality, Lung cancer, Indoor radon mitigation

1. Introduction

Radon is produced by the decay chain of uranium found in variables quantities in rocks and soil. Radon can be generated from the construction materials used (i.e. volcanic tuff) or from water if it contains dissolved radon. The concentration level of Radon is more related to the geological nature of a regional or a local territory; most of radon gases present in houses comes from the soil which is built in, the reason why its levels are the highest in houses' basements since these areas are nearest to the source. Extremely volatile, Radon gas can seep up through cracks in the floors, floor-wall junctions, gaps around pipes/cables, small pores in hollow-block walls, or sumps/drains which will expose individuals to a high risk radionuclides, and may also increase the risk of lung cancer to those subjected to a long-term exposure. Many sources refer to radon as: The highest source of human radiation exposure (UNSCEAR, 2000), the second leading cause of lung cancer after smoking (Miles, 1988; Yang et al., 1999, National Cancer Institute [NCI] Fact Sheet, 2012). Even though radon can accumulate to high levels in closed or poorly ventilated areas, a small amount of its gas will not pose a health risk in open air spaces or well-ventilated areas.

This study was carried out to evaluate various radon issues such as radon emission rate in South Korea and radon mitigation efficiency.

2. Radon health risks

Radon health risks are less known in South Korea (Cheol et al, 2013), and also less documented. For example, in United States, it has been estimated that 20,000 lung cancer deaths per year are related to radon (American Cancer

Society, 2015), and 3 to 15% of all lung cancer patients have been identified to be due to radon (National Institute of Environmental Research, 2015). While in South Korea, there is no research to confirm these US actual facts within the Korean context.

In developed and temperate countries, it is estimated that individuals spend 70% of their time in their private homes, 20% in buildings and 10% working outside or in transport (Melloni et al., 2000). So if there are flaws in the heating/ventilation and air (HVAC) systems, the occupants who naturally spend 90% of their time indoors may experience serious health effects.

3. Radon Mitigation Policy in Korea: Need for action

In Korea, the radon mitigation political awareness is quite new. The Ministry of environment established a comprehensive indoor measurement only in 2007. The same year, measures were seized using a passive radon detector to identify areas having higher than average indoor radon concentrations (measured in Becquerel per cubic meter, Bq/m³) and take accurate data during the winter term, since this is the period where buildings remains closed. There are indeed differences between the seasons. It is known that usually in winter radon levels are increased because of a not well-ventilated room. The director Lee Woo-Seok from the National Institute of Environmental Research (NIER) said that in South Korea, radon concentrations are 30% higher in winter and are much lower in summer because of closing or opening the windows and the influence it has on air quality (NIER, 2015)

Since 2009, the Ministry of environment has focused on an "Indoor Air Quality radon Management Plan" for developing and promoting strategies for mitigation of radon exposure.

The last survey, published in March 2015, was conducted in 6648 survey points using passive detectors producing a

* 동아대학교, 건축 학과
(xdesign@dau.ac.kr)

national radon mapping. It was also necessary to determine whether indoor radon levels were above the Environmental Protection Agency (EPA) recommended levels.

The measurements were carried out during the winter three months period. The results revealed that the average radon concentration of 102 becquerels released per degree m³ (102 Bq/m³). This result is lower than the previous one conducted from December 2011 to February 2012 on 7885 dwellings nationally with an average concentration of 124Bq/m³ (NIER, 2015).

The figure below shows the average indoor radon concentrations in different Korean province.

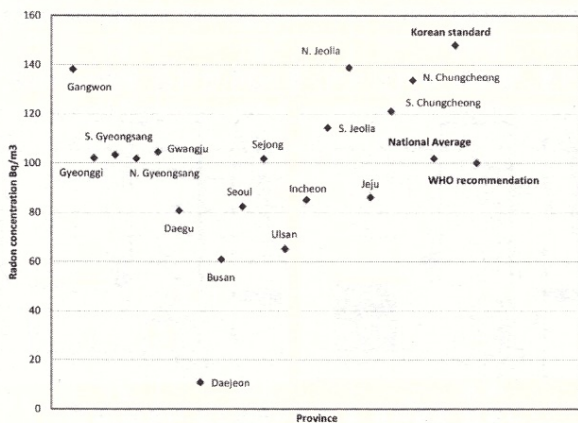


Figure 1. Radon concentration in different Korean provinces. (Source: Living Environment Information Center)

There are distinct differences by region and by the range of average exposures. But these first reported data call for government action to carry out a general study throughout the whole country, establish a control plan to the radon concentrations and protect those vulnerable to radioactivity.

In order to reduce radon health risks, the Korean Ministry of the Environment (KME) has recommended that the indoor radon concentration be less than 148 Bq/m³ which is the same value suggested in the United States (KME, 2010). To achieve this goal, the KME suggested some guidelines such as improving the ventilation systems. Therefore, indoor air quality in buildings is of crucial importance and so are the measures taken to establish improvements to prevent its deterioration, i.e., to prevent any kind of pollutants emitted into the air whether it comes from human activities or from natural sources (Wood, 1991). So, air sealing and other energy retrofits in buildings can raise or lower radon levels, whether the building is more airtight or less airtight, it will have a significant impact on the air exchange in the space. As an example, a well heated home, equipped with energy-saving equipment, is a typical example of deterioration of indoor air quality.

4. Conclusion

It is clear that indoor radon concentrations depend on factors such as the soil, building materials, the ventilation habits of people, airtightness and the design of the building thus the amount of air-change between the indoor and the outdoor. Given many research findings, radon has become a major health problem that needs to be tackled. The basis for the action plan is the reduction of radon concentration.

The Korean government recently started supporting radon detection and management, and working towards radon mitigation. The strategic plan in South Korea should involve:

- ◆ The definition of guideline values based on the new findings on radon.
- ◆ A better understanding of the effective exposure of the population to radon; through mapping the zones at risk and the constant measurements, seen as necessary.
- ◆ An improvement in radon control through building regulations.
- ◆ The endorsement of radon-free buildings requirements: building standards and codes.
- ◆ The adoption of national policy and local ordinances. Policies for testing, mitigation for the existing building stock and new constructions.
- ◆ The promotion professionals education and homeowners concerns.
- ◆ The involvement of Korean researchers because obviously radon-related studies in Korea are minimal compared to those in foreign countries

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