

Dear Dr. István Lagzi,

I would like to thank you for the comments. Care will be taken to improve the work and address your concerns as per the specific comments below. I am grateful for the time and energy you expended on our behalf.

Comment 1. Please describe how the rooms with the well-ventilated or poor ventilated conditions can be quantified or recorded.

Answer: Thanks to this comment. To address this comment, we assumed the house with natural ventilation (drive outdoor air through purpose-built, building envelope openings) as a poor ventilated one and house with mechanical ventilation system (by installing fans on the wall or in air ducts for supplying air into, or exhausting air from, a room) as a well-ventilated house.

Comment 2. Please explain the difference in the seasonal change of indoor thoron and radon in the Mashhad case study.

Answer: Thanks, the reason of heterogeneous behaviour of seasonal variations in ^{222}Rn and ^{220}Rn concentrations might be that the source of ^{220}Rn mainly limited to the concentration of ^{232}Th (^{228}Th) in building materials, while in case of Radon, ground is in addition. Therefore, in summer due to high air exchange rate, e.g., using ventilator, opening windows, the concentration of both ^{220}Rn and ^{222}Rn goes down, while in winter as the air exchange rate is lower than summer, the concentration of ^{220}Rn and ^{222}Rn build up but as the source of indoor ^{222}Rn is both ground and building material rather than the only source of ^{220}Rn as building materials, the seasonal change of indoor thoron concentration is less than that of indoor radon.

Comment 3. Figure 22; The applicant wrote in the thesis: “The correlation analysis yielded a positive correlation ($R^2=0.361$) between average indoor radon and soil-gas radon concentrations.” Based on the results presented in Figure 22, (average data and error bars), I would observe no or very weak correlation between two quantities. If there is a correlation between the indoor radon and soil-gas radon concentrations, what is the scientific origin of it.

Answer: Thanks to this comment. That is true, based on the numbers of house studied, the correlation between the indoor radon and soil-gas radon concentrations, was low; then by increasing the number of cases, it might be going higher. Another reason is possibly because of the physic geological properties of the types of soil studied, topographic differences, as well as

geomorphology and meteorological conditions of the region. Geologically, the Kalaj mountains, which consist of granitic hills covered by silty deposits, are situated to the south of Mashhad, towards the northwest is Kale Ghaemabad that is comprised of more sandy soil, and in all other directions is a plateau with a mix of clay loam and soft sandy soils. However, it was proven that indoor radon (^{222}Rn) and thoron (^{220}Rn) concentration might directly depend on the activity of ^{226}Ra and ^{232}Th (^{228}Th) in building materials, ground is the main entry path of radon at dwellings.