

Short Communication

Evaluation of the radiation dose from radon ingestion and inhalation in water

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Radon and its radioactive progenies in indoor places are recognized as the main sources of public exposure from the natural radioactive sources. The tap water used for drinking and other household uses can increase the indoor radon level. In the present research, drinking water samples were collected from various places and supplies of public water used in Mashhad city which has about 4 million population. Then radon concentration has been measured by PRASSI system three times for each sample. Results show that about 75% of water samples have radon concentration gathered than 10 Bq/L which advised EPA as a normal level. According to measurements data, the arithmetic mean of radon concentration for all samples was 16.238 ± 9.322 Bq/L. Similarly, the annual effective dose in stomach and lung per person has been evaluated in this research. According to the advice of WHO and EU Council, just 2 samples induced the total annual effective dose greater than 0.1 mSv/y.

Key words: Radon, effective dose, drinking water, PRASSI system, Mashhad city.

INTRODUCTION

Radon (^{222}Rn) is a naturally occurring radioactive noble gas with a half-life of 3.82 days, which is a member of the ^{238}U decay series (Somlai et al., 2007). Radon and its short-lived decay products such as ^{218}Po , ^{214}Pb , ^{214}Bi and ^{214}Po at indoor places are recognized as the main sources of public exposure from the natural radioactivity, contributing to nearly 50% of the global mean effective dose to the public (Somali et al., 2007; UNSCEAR, 2000). The type of soil, building materials and water used for drinking and other household uses can make variable contributions to the indoor radon level (Sohrabi, 1998). The available data indicate that the main source of the indoor radon is the soil underlying a building (UNSCEAR, 1993). However, certain building materials with high concentrations of radium and even domestic water with high concentrations of radon can make major contributions to indoor radon exposure (Kearfott, 1989; Li et al., 2006). The most important aspect of radon in high concentrations can be health hazard for humans, mainly a cause of lung cancer (Folger et al., 1994; Khan, 2000). However, a very high level of radon in drinking water can

also lead to a significant risk of stomach and gastrointestinal cancer (Zhuo et al., 2001; Kendal et al., 2002). Knowledge of the levels of radon in each source including household water, particularly water from groundwater sources, is necessary to protect the public from consequences of excessive exposure to radiation, mainly from the risk of lung cancer.

In Iran, the household water is supplied from various sources. Due to the dry climate condition in most parts of the country, drilled wells have provided the main section of drinking water used by the public. In a few parts with high annual rain, surface water is the main source for public usages. In a number of cities, including Mashhad, both groundwater and surface water are the sources of household water. Domestic water of Mashhad, the second big city of Iran after Tehran, which has about 4 million fixed population and more than 12 million religion tourists and business persons, is supplied from two Torogh and Kardeh dams and more than 84 deep wells drilled in and around the city. Depending on the raining condition, the contribution of groundwater to the supplied domestic water, particularly in summer season, may increase. Depending on the geographical situation of a specified region in the city, domestic water may be supplied from groundwater, surface water or a mixture of them.

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mixing with surface water in large reservoirs or aerate water in order to allow some radon removal from the water. It is evident that if the wells are to be the only water supply for some parts of Mashhad, the required remedial action should be taken to reduce radon concentrations consumed by people.

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