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Archives of Applied Science Research, 2010, 2 (1) 143-146
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-508X
CODEN (USA) AASRC9

Radon Concentration Measurement in the Some Water and Air of Mine in Nishabour Region at Iran

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Abstract

The ^{222}Rn radioisotope with 3.8 days decay half-life is produced form ^{238}U natural series and the ^{220}Rn radioisotope with 55 sec decay half-life form ^{232}Th natural series. The radon gas can enter to the body via respiring, drinking and eating. The alpha emitted by this gas and other radiation emitted by its daughters increase the absorbed dose in respiratory and digestion systems. Nearly 50% of annually radiation dose absorption of human is due to radon which is one of the main cancers cause at respiratory and digestion systems. In this work, radon concentration in the 22 air positions and 8 water samples of mine in Nishabour region at Iran has been measured with PRASSI system. The result shows 12 air samples and 5 water samples have radon concentration gather than the normal level.

Key words: Radon; Radon concentration in air and water; mine in Nishabour region.

Introduction

The ^{222}Rn radioisotope with 3.8 days decay half-life is produced form ^{238}U natural series and the ^{220}Rn radioisotope with 55 sec decay half-life form ^{232}Th natural series [1,2]. The radon gas can enter to the body via respiring, drinking and eating. The alpha emitted by this gas and other radiation emitted by its daughters increase the absorbed dose in respiratory and digestion systems. Nearly 50% of annually radiation dose absorption of human is due to radon which is one of the main cancers cause at respiratory and digestion systems [2].

Some recent reports of large radon concentration in water supplies in different places [3-7] caused we concern to measure radon concentration in air and water samples of mine in Nishabour region at Iran. However, till date no study of radioactivity in the water has been carried out or reported for this region. The present's research work is the first ever report of radon measurements the region by PRASSI system.

Radon measurement in air by PRASSI system

The PRASSI (Portable Radon Gas Surveyor SILENA) Model 5S has been use for radon concentration in air measurement. PRASSI pumping circuit operates with constant fallow rate at 3 litters per minute and its detector is a scintillation cell coated with Zn S (Ag) 1830 cm^3 volume.

In this work, radon concentration in the air of 22 positions has been measured with PRASSI system. Fig. 1 shows the histogram of radon concentration at 22 of places. The result demonstrate about 40% of positions have radon level low than the normal level (48 Bq/m^3), as shown in Fig. 2. Some of the positions have radon level exceed the normal level up to 5-6 times! We must mention the outdoor radon was 16.528 Bq/m^3 in that time.

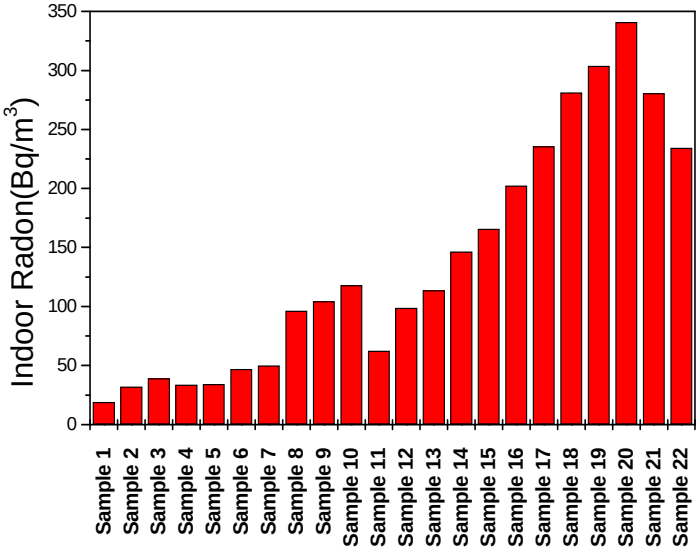

Fig. 1: The histogram of radon concentration in the air of 22 positions

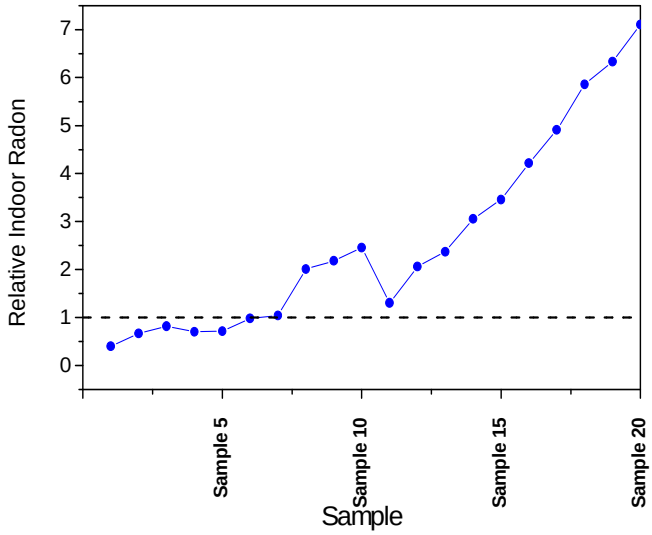

Fig. 2: Relative radon concentration of the 22 air positions (the measured data are normalized to 48 Bq/m^3 as normal indoor radon level)

Radon Measurement in Water

Water sampling

To measure radon gas in water, some care must be taken in sampling process. Usually, springs and deep wells waters are reach in radon, but after the water has been steered a little, it losses the highest fraction of its content. So, we have taken the water sample directly from the sources, about 30 cm under the free surface of water.

PRASSI system set up of radon measurement in water sample

The system is particularly well suited for this type of measurement that must be performed in the closed loop circuit. PRASSI pumping circuit operates with constant fallow rate at 3 litters per minute in order to degassing the water sample properly. Fig. 3 shows the system set up of measurement including bubbler and drier column.

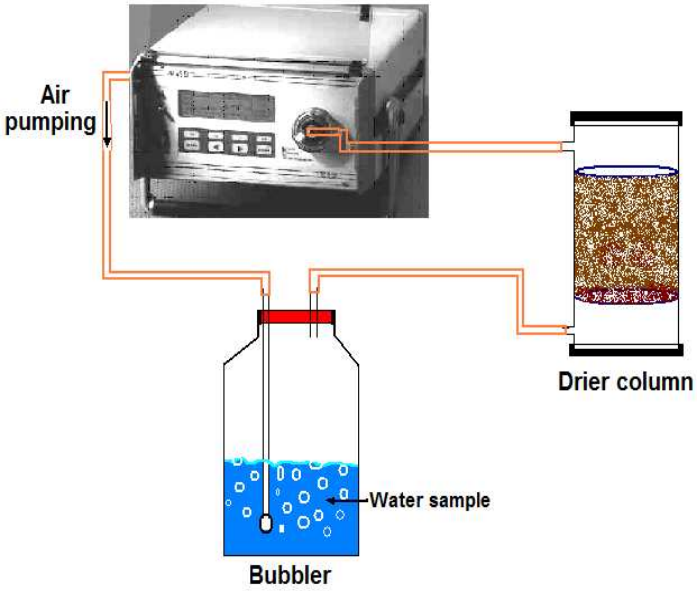

Fig. 3: The PRASSI system set up for radon measuring in the water sample

Radon concentration in the 8 water samples of mine in Nishabour region has been measured. The result of radon concentration in different the water samples are listed in Table 1 which show 6 samples have radon concentration gather than 10 Bq/l as the normal level.

Table 1: Radon concentration data of different water sources of mine in Nishabour

Sample No.	Radon level (Bq/l)	Sample No.	Radon level (Bq/l)
Sample 1	15.89	Sample 5	15.42
Sample 2	7.54	Sample 6	9.37
Sample 3	16.62	Sample 7	28.65
Sample 4	15.03	Sample 8	35.41

Conclusion

Nearly 50% of annually radiation dose absorption of human is due to radon which is one of the main cancers cause at respiratory and digestion systems. A section of radon come in body is due to drinking water and breathing process, so for improvement of the social health level,

it would be better to use the low radon level water source, or reduce the radon in the drinkable water before using by people. The results show 6 samples have radon concentration gather than 10 Bq/l as the normal level.

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