

Concentration of Radon and its Progeny Levels in water in District Moradabad of Western Uttar Pradesh

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Abstract

Radon concentration in ground water from different locations of Moradabad district of Uttar Pradesh was measured during year-2012. Water samples were collected from the selected locations around Moradabad City from manually operated bore wells, open wells, lakes and running water. To estimate ^{226}Ra activity, 20 liters of water was collected and pre-concentrated by chemical methods. The pre-concentrated sample of about 60 ml was then transferred to and evacuated radon bubbler. An evacuated scintillation cell was then connected to the bubbler and radon in the water was transferred to the cell. The cell was coupled to an alpha counter for analysis. The radon and radium concentration in water was determined by measuring the net alpha counts using a standard procedure. The graphs were plotted for radon concentration versus number of houses for different seasons. The resulting radon concentration level due to radon varied from 28.34 Bq/l to 40.98Bq/l. The observed radon concentration in ground water was found to be lower than the ICRP recommended value and thus are within safe limits.

Keywords: Radon; Radon bubbler ; Scintillation cell; Alpha counter;

Introduction

Naturally occurring radionuclides are frequently measured in ground waters. Of these radionuclides, radon (^{222}Rn) has sufficient properties, solubility, and half-live (3.8 d) that during household use of groundwater (showering, cooking, or washing dishes and clothes) the dissolved radon can contribute substantially to indoor-air levels (Fitzgerald, 1997). The radon released from the water into the home's air will contribute to the radon concentration in the indoor air[1].The global value of radon concentration in water range from 500 pCi/l to 170.00 pCi/l (Fleisher et.al., 1965).Radon is very soluble in water (Fleisher, 1988).

In equilibrium with radon gas at a partial pressure of one atmosphere, the solubility range from 51cc of radon per 100cc of water at 0°C to 13cc per 100cc of water at 50°C [2].Studies from deferent parts of the world show that well planned and systematic measurements of radon activity concentrations for all seasons during a calendar year are necessary to calculate the actual dose due to radon. Maps of radon prone areas showing different potential radon emission levels are very helpful to assist the authority in identifying populations with a higher risk of radon gas exposure. [3] Based on a National Academy of Science re-

port, EPA estimates that radon in drinking water causes about 168 cancer deaths per year: 89% from lung cancer caused by breathing radon released to the indoor air from water and 11% from stomach cancer caused by consuming water containing radon Due to recent surveys in Dehradun [4] and nearby towns of U.P [5] suggest a little higher concentration of radon than the normal one, hence radon concentration survey was required for different regions of the state. So Moradabad district of western Uttar Pradesh are chosen as study area. The aim of proposed investigation is to carry out the systematic study of radon and their daughter products in relation to their application in radiation protection

Study area

The measurements of groundwater radon concentration were made in various locations of Moradabad district of western Uttar Pradesh.

Experimental method

The radon and its daughter products in environment were measured in 66 locations of the Moradabad district of western Uttar Pradesh. The measurement in drinking water will be made by Alpha-Scintillometer. In this 750 ml water is taken in radon light reagent bottle of one liter capacity connected in a closed with ZnS coated detection chamber through a hand operated rubber pump and a glass tube containing Calcium Chloride to absorb the moisture. The air is circulated in a closed circuit for a period of ten minutes till radon forms a uniform mixture with air and resulting alpha activity is recorded. Lucas cell is used to grab a gas sample, filter out the radon daughter through a special filter at 0.01 microns, and counts the radioactive decay of radon gas.

Fig.1

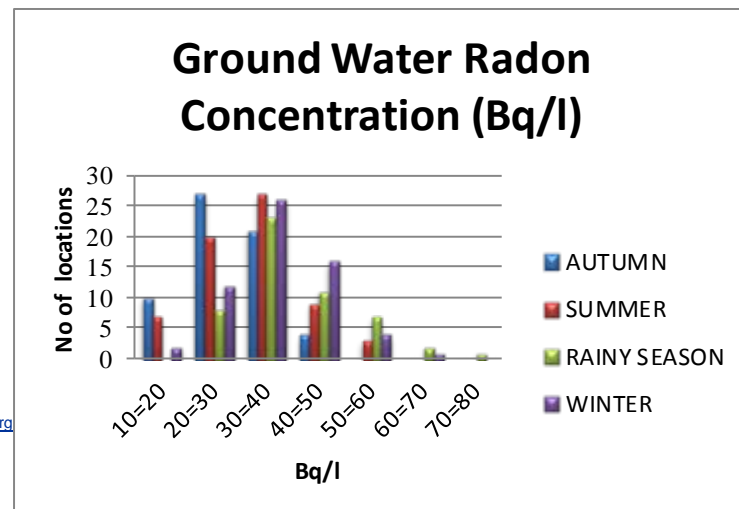
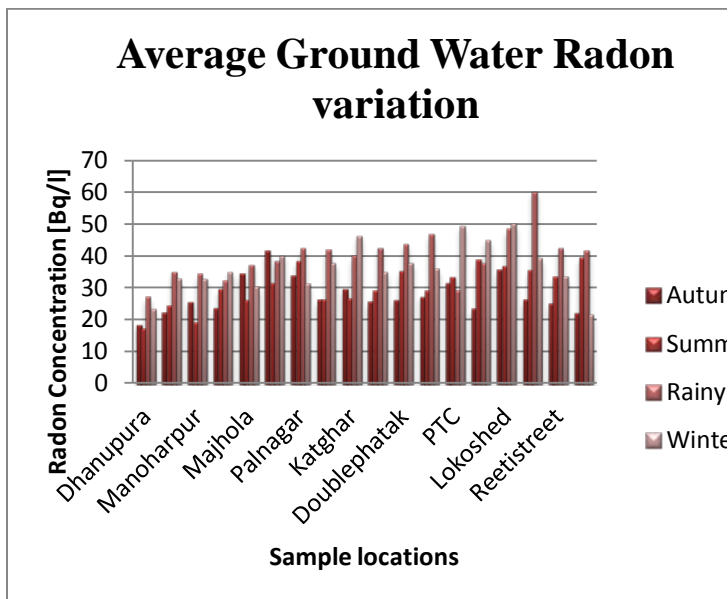


FIG.2.



Results and Discussion

Measured values of radon for four different seasons of a calendar year are shown in Fig.1. In autumn season the radon concentration in **water** varies from 15 Bq/l to 48 Bq/l with an average of 28.34 Bq/l. During summer season indoor radon concentration was found to vary from 14 Bq/l to 48 Bq/l with an average of 30.54 Bq/l. During monsoon radon concentration was found to vary from 21 Bq/l to 77 Bq/l with an average of 40.98 Bq/l. During winter radon concentration was found to vary from 17 Bq/l to 61 Bq/l with an average of 37.34 Bq/l. It is found that the overall average value of radon concentration is maximum (40.98 Bq/l) during rainy season and minimum (14 Bq/l) during summer season.

It was observed that radon concentrations in ground water are governed by the litho logy of the study area. Observed data reveal that radon concentration is low in air and slightly higher in ground water. In rainy season flow of water through rivers and canals come to the ground and increase the level of water, Because of this the radon kept low in other seasons flow upwards with water level and hence a slight increase in the radon concentration is observed.

At the same time flow of radioactive atoms from hilly region reach to the planes of Moradabad, which is one of the reason in the increase of concentration in water.

However, the recorded values of radon and progeny and resulting doses are well below internationally recommended levels (ICRP, 1993). This clearly indicates that the locations in Moradabad district of Uttar Pradesh are quite safe from the radiation protection point of view.

Conclusions

Based on the results obtained from the study area, the activity concentrations of Ground water Radon in the locations of Moradabad district of Uttar Pradesh is studied for all four seasons. The resulting doses were found to be well below internationally recommended levels and are within the safe limit from the radiation protection point of view.

References

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