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Research Article

Radioactivity level in drinking water of Gulbarga district Karnataka, India.

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Abstract:
Radon concentration was assessed in 20 water samples collected from hand pumps, tap water and bore wells collected from some areas of Gulbarga, Karnataka, India. Water samples were analyzed by using Emanometry method. ^{222}Rn activity concentration in ground water varies from 1.11 to 66.6 Bq $L^{-1}$with the mean value of 28.3 Bq L^{-1}. About 35 % of the water samples actually used by the inhabitants of the region are having radon concentration greater than the MCL of 11 Bq l^{-1} recommended by EPA.

Key words: Drinking water, leaving organism, WHO, Radiation, Radon activity

Introduction:

Radiation is well known from earlier studies that the gamma radiations emitted from ^{238}U, ^{232}Th and ^{40}K present in soil, rock, water, sand and other environmental materials contribute significantly to the collective dose received by organisms are due to ionizing radiations. The contribution from these kinds of components varies with location and altitude. The concentrations of these radio nuclides in geological materials are different for different materials so that the environmental gamma levels are also different. The concentrations of the natural radionuclides depend on local geological and geochemical processes, drainage pattern and human intervention. The radiation received by the human beings is primarily due to the source of stored natural radioactivity in

soils, rocks, granites , water or any other geological material of the universe, which are derived essentially from gamma rays of different energies emitted by ^{40}K and the members of ^{238}U and ^{232}Th decay series. Natural radioactivity measurement, dose assessment and interpretation of radiological related parameters and radiation monitoring of the region are crucial aspects from the public awareness and environmental safety point of view.

Determination of naturally occurring radionuclides in groundwater is useful as a direct input to environmental and public health studies. The concentration of uranium series radionuclides in groundwater may vary over several orders of magnitude depending on source material, physical and chemical parameters that control the release, uptake and distribution of each radionuclide in water. High natural levels of alpha radioactivity in groundwater are often associated with areas of granite bedrock (Ortega). In groundwater; uranium is not usually in equilibrium with its progeny. The reasons for this behavior are differences in the mobilisation in groundwater and physical–chemical processes such as physical half-lives of these nuclides, their transport between rock and water systems and their water chemistry

Materials and method

Study area

20 Drinking water samples were collected from Gulbarga district located in the northern part of the Karnataka state, India. The soil types in the study region are mainly black soil [S Rajesh]. The area is surrounded by the plane surface and small hills in certain directions which have an abundant resource of the stone, which are highly deformed in nature and utilizing natural recourses in large scale. It will be of interest to examine the variation of environmental radiation dose rates due to various activities like stone mining in the study area. The levels of radioactivity can be used to assess public dose rates and radioactive contamination and predict changes in environmental radioactivity caused by nuclear accidents, industrial activities, and other human activities **[**Ghazwa Alzubaidi]

Estimation of radon level in water samples

The water samples were collected from the few locations from Gulbarga city from Borewell, tap water and wells. The main objective of the study is to monitoring the amount of radon in ground water is its usage for various purposes, such as drinking, washing, irrigation, bathing, etc. About an 100 ml of water sample was collected in airtight plastic reagent bottles with minimum disturbance. The bottles were gently and completely filled so that zero headspace was present [M. S. Chandrashekara]. Care was taken to see that no air bubbles were present inside the container and also to avoid aeration during the sampling process, which might lead to out gassing [M.C. Srilatha].The samples were brought to the laboratory with minimal loss of time and were analysed immediately. The activity concentration of 222Rn in water was estimated by the emanometry as shown in Figure 1. In this method, about 40–60 ml of the water sample was transferred into the bubbler by the vacuum transfer technique. The dissolved radon in the water was transferred into a pre-evacuated and background counted scintillation cell. The scintillation cell was stored for 3 hours to allow radon to attain radioactive secular equilibrium with its daughters products and then it was coupled to a photomultiplier and alpha counting assembly and finally, concentration of radon samples have been measured using the relation.[Raghavayya M]

Sl No.	**Sampling Area**	**Range**	**^{222}Rn Activity Water (Bq L^{-1})**

1	Gulbarga City	Min	1.11
		Max	66.6
		Mean	28.3
2	Gulbarga Rural	Min	1.25
		Max	56.7
		Mean	27.3

The activity of ^{222}Rn (Bql^{-1}) in the sample was determined using the equation.

$$Rn^{222}(Bq \cdot l^{-1}) = \frac{6.97 \times 10^{-2} \times D}{E \times V \times (1 - e^{-\lambda S_t}) \times e^{-\lambda S_c}}$$

where D is the counts per second, V the volume of water, E the efficiency of the scintillation cell (74 %), λ the decay constant of radon (2.098X10^{-6} s^{-1}) T the counting delay after sampling, t the counting duration and s the build-up time in the bubbler.

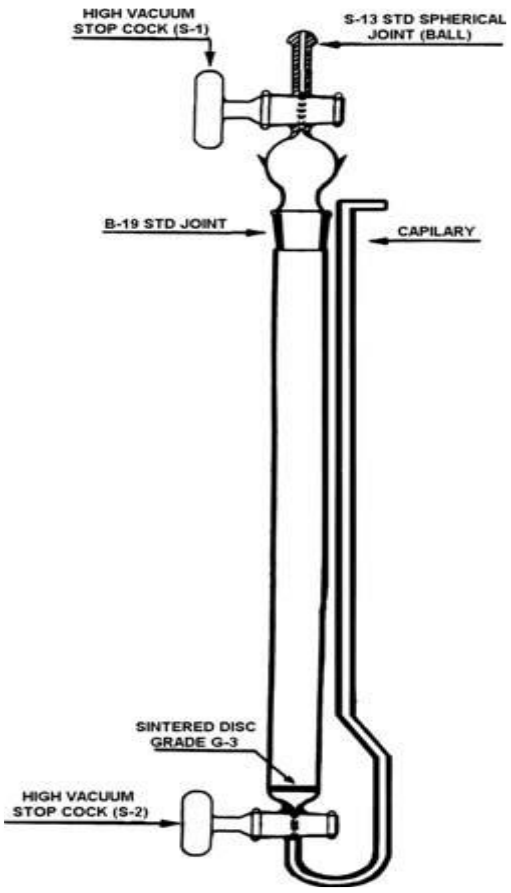

Figure: 1 Schematic diagram of emanometry method (radon bubbler)

Conclusion.

^{222}Rn activity concentration in ground water varies from 1.11 to 66.6 Bq L^{-1}with the mean value of 28.3 Bq L^{-1} .About 35 % of the water samples actually used by the inhabitants of the region are having radon concentration greater than the MCL of 11 Bq l^{-1} recommended by EPA. All the drinking water samples have radon concentration found to be well below the action level of 100 Bq l^{-1} recommended

by European Commission. Although, according to the recommendation of WHO and the EU Council the mean annual effective ingestion doses received from all samples are lower than 0.1 mSv year^{-1}.

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