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Radon Pollution Studies in the Environs of Radioactive Areas by Using Solid State Nuclear Track Detectors

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Abstract—Out of the total radiation dose received by man from natural sources and from medicine, 40% is due to radon. Abnormally high doses of radon can constitute a health hazard and affect people living in the vicinity and give rise to premature deaths. In the present paper the results of radon activity recorded in domestic regions of the Rameda area (Himachal Pradesh, India), which has a known uranium mineralization, are reported. The preliminary investigations in this area show about 10–20 times higher radon activity compared to that observed in non-radioactive areas.

1. INTRODUCTION

Radon is present in trace amounts almost everywhere on earth being distributed in the soil, groundwater and in the lower levels of the atmosphere. It is particularly important as a health hazard in mines, in mills and other places where people live and work. The daughter products of radon, ^{218}Po, ^{214}Pb, ^{214}Bi and ^{214}Po, which are solid under ordinary conditions, attach themselves to atmospheric dust. During inhalation these particles may deposit in the lung and damage the tissue.

In domestic areas, the main sources of radon are the soil and rocks beneath houses, construction materials (sand, rocks, cement, concrete, etc.) which contain traces of ^{238}U, ^{226}Ra and ^{40}K, and the associated water supply. The present investigations were carried out in the dwellings of the Rameda village (Himachal Pradesh, India), situated on a radioactive site in the lower Himalayas.

2. EXPERIMENTAL PROCEDURE

In the present work the solid state nuclear track detector (SSNTD) technique was used for the radon measurements.[1–3] LR-115 (type II) plastic, which is sensitive to α-particles was employed as a track recorder. Small pieces (1×1 cm^2) of this plastic were fixed on glass slides and the slides were fixed at the same height on walls of houses chosen at random. One room was taken in each house for our study. Some slides were fixed in the open for outdoor measurements in the shadow of the sun. After an exposure of one month, the samples were removed, etched in 2.5 N NaOH at 60°C for 2 h and scanned for measurement of track density. The track densities so obtained were converted into pCi/L using a calibration constant (35.6 tracks/cm^2/m = 1 pCi/L) determined by Singh *et al.*[4] in this laboratory.

3. RESULTS AND DISCUSSION

Table 1 gives the value of radon activities recorded in dwellings at Rameda. The right, front and left sides to the entrance were taken as A, B and C, respectively, and the entrance side as D (Fig. 1).

Table 1. Indoor and outdoor radon activity (pCi/L) measurements at Rameda village (Himachal Pradesh)

House No.	Sample position					Average indoor value
	Wall A	Wall B	Wall C	Wall D	Open (O)	
I	46.96	61.57	69.51	31.96	18.79	52.51
II	32.93	38.30	55.85	29.52	12.45	39.15
III	93.90	58.29	83.16	38.30	—	58.41
IV	61.70	50.00	71.46	38.78	—	55.48
V	63.65	58.78	78.77	59.75	19.77	65.23
VI	69.99	61.70	69.02	36.83	—	59.38
VII	39.76	50.49	50.97	59.26	—	50.12
VIII	48.05	48.49	52.93	52.44	—	50.36
IX	33.42	29.03	—	21.23	—	27.89
X	65.12	—	47.07	—	18.79	56.09

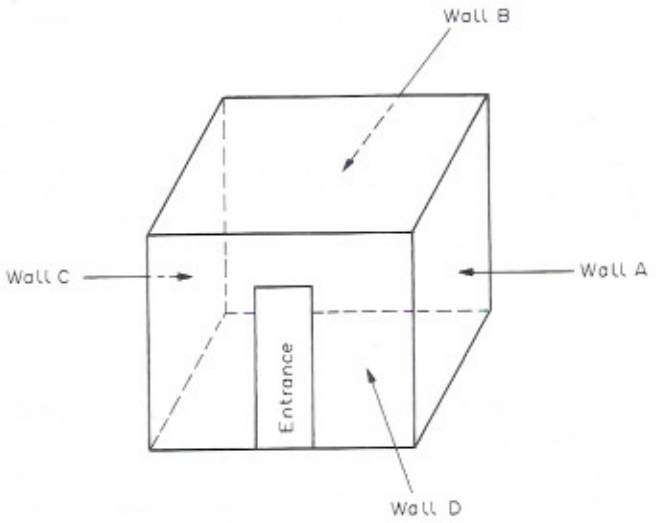

Fig. 1. Configuration of residential room.

A maximum average activity of 65.23 pCi/L was found in house V while a minimum of 27.89 pCi/L was observed in House IX. These concentrations are 10–20 times higher than the levels found in the non-radioactive area at Amritsar (2.83–4.02 pCi/L).[5] The high values of radon activity may be due to the presence of radioactive stones used in the construction of houses or to seepage from the basement.

The value of the indoor radon activity is, on average, almost three times higher than that of the outdoor value. Also, in general, the activities on sides B and D are smaller than on sides A and C, due to the dilution caused by the mixing of outside air.

Our preliminary results show that these houses may not be safe for living; there may be a health hazard due to the observed high values of radon. Our detailed investigations in this area are in progress.

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