

MEASUREMENT OF RADON ACTIVITY AT SOME RADIOACTIVE SITES IN INDIA

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ABSTRACT-

The present study deals with the evaluation of radon levels in some houses at the radioactive sites of Himachal Pradesh, India. In one of the areas under study, the radon activity is found to be 983.60 Bq/m^3 in summer and 1115.04 Bq/m^3 in winter giving an annual exposure dose of 45.94 mSv to the inhabitants. In the second area these levels are found to be 611.92 Bq/m^3 and 685.14 Bq/m^3 , respectively, exposing the people to an annual dose of 28.39 mSv . The life time risk coefficients of lung cancer in these areas are 8.25×10^{-2} and 5.1×10^{-2} respectively.

INTRODUCTION

Almost one half of the natural radiation exposure received by human is from radon and its solid progeny in air⁽¹⁾, which can result in a significant risk to the general public. Until few years back it was considered to be a health hazardous only to the workers engaged in the mining and milling of uranium, but now surveys carried out all over the world⁽²⁻⁴⁾ shows high concentrations of radon in some dwellings that could entail significant health risks.

The daughter products of ^{222}Rn viz; ^{218}Po , ^{214}Pb , ^{214}Bi , ^{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. It is therefore, necessary to monitor levels of radon in places where people are exposed to radon, particularly at sites where the geological formations are enriched with uranium. So we have chosen two sites in radioactive areas-Rameda and Samurkalan in Himachal Pradesh, India.

EXPERIMENTAL TECHNIQUE

Track etch technique (LR-115 Type II) has been used for the measurement of radon activity in the dwellings. Small pieces (1 cm^2) of LR-115 were used to measure the radon activity in winter as well as in summer season. The detailed methodology of the experiment is given elsewhere⁽³⁾. The track density was converted⁽⁵⁾ into the units of Bq/m^3 using a calibration constant assuming an equilibrium factor of 0.5 between radon and its progeny.

RESULTS AND DISCUSSION

Radon measurements have been carried out in 18 houses of Rameda and 19 houses of Samurkalan villages. The choice of dwellings was random and one living room of each dwelling was selected for radon measurement. Tables 1 & 2 give the radon activity recorded in the houses of Rameda for the summer and the winter seasons, respectively. The right, front and left sides to the entrance are designated as wall A, wall B, wall C respectively and the entrance side as wall D. In both of these areas walls and floors have been constructed from local sand stones covered with a paste of mud. The roofs are made of wood. The surveyed houses are not properly ventilated.

WALL TO WALL VARIATION

From the Tables 1 and 2 it is clear that there is a large variation of radon activity from wall to wall in the same room. This variation shows that the members of a family while living in the same room may be exposed to different levels of radon activity depending upon their sitting side or bedside. This variation may be attributed to the fact that certain positions in a room may have more quantity of uranium enriched rock species than to the others and also on the ventilation system of the rooms.

HOUSE TO HOUSE VARIATION

The radon activity in the Rameda area varies from one house to the other as much as $489.14 - 2305.19 \text{ Bq/m}^3$ (Table 1) and $542.05 - 1975.98 \text{ Bq/m}^3$ (Table 2) during the summer and winter seasons, respectively. It is evident from this fact that the people while living in the adjacent houses at radioactive areas can have different exposures of radon activity.

SEASONAL VARIATIONS

The average radon activity recorded during the summer and winter seasons in the Rameda area is 983.60 Bq/m^3 and 1115.04 Bq/m^3 , respectively. This variation is due to changed ventilation system for the summer and winter seasons. During winter season the houses are made air tight, as a result the ventilation is reduced and hence less mixing with the outdoor air which causes more accumulation of radon and its daughter product activity indoors.

Similar variations are noted in Samurkalan area. The average radon activity recorded in this area is 611.92 Bq/m^3 and 685.14 Bq/m^3 in the summer and winter seasons, respectively.

LUNG CANCER RISK

The average annual radon activity comes out to be 1049.32 Bq/m^3 and 648.53 Bq/m^3 in the Rameda and Samurkalan areas

repectively. This much radon activity gives an average annual exposure dose of 45.94 mSv and 28.39 mSv, respectively to the inhabitants of these areas. The life time lung-cancer risk-coefficients for the Rameda and Samurkalan areas⁽⁶⁾ are found to be 8.25×10^{-2} and 5.1×10^{-2} , respectively.

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Table 1. Radon activity (Bq/m^3) recorded in the village Rameda (H.P., India) during the summer season and the annual dose delivered to the inhabitants (mSv).

House code	Radon Activity (Bq/m^3)				Average	Annual Dose (mSv)
	Wall A	Wall B	Wall C	Wall D		
R-1	0854.70	0535.39	0962.74	0507.64	0715.11	31.31
R-2	0617.16	0646.39	0579.79	0560.92	0601.06	26.31
R-3	1167.35	1524.40	1136.27	0943.13	1192.78	52.22
R-4	0819.92	0699.67	1121.47	0731.86	0843.23	36.91
R-5	2033.52	2023.90	2402.78	2760.57	2305.19	100.93
R-6	0849.15	1137.38	0635.66	0738.15	0840.08	36.78
R-7	1660.56	0995.30	1148.85	1089.65	1223.94	53.58
R-8	0947.94	0784.03	0936.10	0827.69	0873.94	38.26
R-9	0804.01	1055.98	0655.64	0624.93	0785.14	34.37
R-10	1356.42	-	1489.99	1545.49	1463.96	64.09
R-11	0868.02	0807.71	0763.68	-	0813.13	35.60
R-12	0363.34	0422.17	0913.16	0512.82	0552.87	24.20
R-13	0475.45	0416.62	0492.84	0571.65	0489.14	21.41
R-14	1068.19	0907.98	1109.24	0595.70	0920.28	40.29
R-15	1292.41	-	1282.42	0806.60	1127.14	49.35
R-16	1041.55	0888.00	0934.62	0630.48	0873.66	38.25
R-17	1673.51	1476.67	1216.93	0641.95	1252.26	54.82
R-18	0659.71	0790.32	0875.79	0563.51	0722.33	31.62
Overall mean value					0983.60	43.06

Table 2 Radon activity (Bq/m^3) recorded in the village Rameda (H.P., India) during the winter season and the annual dose delivered to the inhabitants (mSv).

House code	Radon Activity (Bq/m^3)				Average	Annual Dose (mSv)
	Wall A	Wall B	Wall C	Wall D		
R-1	1031.56	0835.83	1341.62	0741.85	0987.71	43.24
R-2	0593.33	0657.86	0937.58	0449.55	0660.08	28.90
R-3	0879.86	1329.41	-	0719.65	0976.30	42.74
R-4	1134.79	0762.57	-	0860.25	0919.20	40.24
R-5	1700.15	1893.29	2079.40	2231.10	1975.98	86.51
R-6	1217.67	-	1138.12	0907.24	1087.67	47.62
R-7	2182.63	1086.69	1498.50	1389.35	1539.29	67.39
R-8	1334.59	1058.94	1176.23	1045.25	1153.75	50.51
R-9	1014.17	1445.22	1065.97	1355.31	1220.16	53.42
R-10	1542.53	-	1417.47	1495.54	1485.18	65.02
R-11	1234.32	1283.16	1210.64	1307.21	1258.83	55.11
R-12	0535.76	0676.37	0612.72	0618.27	0610.78	26.74
R-13	0543.90	0563.88	0510.97	0549.45	0542.05	23.73
R-14	0833.61	0544.27	1366.78	0445.48	0797.53	34.91
R-15	1438.19	-	1100.38	1576.20	1371.59	60.05
R-16	0828.06	0950.53	1189.92	0847.67	0954.04	41.77
R-17	1531.06	1325.71	1482.96	-	1446.57	63.33
R-18	1064.86	1134.79	1201.02	0975.69	1094.09	47.90
Overall mean value					1115.04	48.82