CPUH-Research Journal: **2018,** ***3(2),*** 213-215
ISSN (Online): 2455-6076
http://www.cpuh.in/academics/academic_journals.php

Health Effects of Radon Gas in Hamirpur District of Himachal Pradesh

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ABSTRACT: This paper is focused to investigate the health effects of indoor radon concentration in Hamirpur area of Himachal Pradesh. Radon concentration is measured at twenty locations in Hamirpur district by using LR -115 type II solid state nuclear track detectors (SSNTDs). Measured radon concentration is used to calculate absorbed doses, equivalent dose and annual effective dose (to lung). Radon concentrations found varies from 47 to 215 Bqm^{-3}, absorbed dose found to varies from 0.59 to 2.71 mSv/yr, equivalent dose varies from 11.86 to 54.24 mSv/yr and effective dose (to lungs) varies from 1.42 to 6.51 mSv/yr. All these values are well within the recommended action level.

Keywords: Radon; LR -115; lung

INTRODUCTION

The radioactive noble gas radon obtained from the radioactive decay of radium. Radon is not chemically reacts with environment, but due to the pressure difference between the soil and the indoor air, the transportation of radon with the help of gases like carbon-dioxide and methane was happened into the atmosphere [1]. The concentration of radon in the indoor air depends upon a number of parameters such as temperature, pressure, nature of building materials, ventilation conditions, wind speed and metrological conditions. Radon is present almost everywhere in the world. Radon concentration varies from dwelling to dwelling. Radon generates the main natural radiation exposure for human beings and has been recognized as a carcinogenic gas [2]. Henshaw et.al has claimed that the radon exposure is associated with the risk of leukemia and certain other cancers, such as melanoma and cancer of kidney and prostate [3]. Radon is one of the cause for lung cancer among non-smokers. Inhaled Radon is responsible for about 2900 deaths of those people yearly, who have never smoked in the world [4]. Long-term exposure to elevated indoor radon concentrations has been determined to be the second leading cause of lung cancer in adults after tobacco smoking [5]. The radon gas can enter into the body through respiring, drinking and eating. More than half of the body's intake of airborne material during a lifetime is the air inhaled in the home. Thus, most illness related to environmental exposures stem from indoor air exposure [6]. For the health risk assessment for general population, it is quite important to make a systematic study of the indoor radon in dwellings. For this purpose, radon measurements have been carried out in a number of dwellings in Hamirpur district of Himachal Pradesh, India.

MATERIAL AND METHODS

In the present investigations the indoor radon concentration has been studied in twenty locations of Hamirpur district of H.P, India. The dwellings were chosen randomly. The LR -115 type II SSNDs has been used to measure the level of indoor radon concentration in the dwellings. The LR-115 type II detectors having a size of about 2cm× 2cm fixed on micro glass slides were suspended at the centre of the room in the bare mode for a period of 90 days. The exposed detectors were etched in 2.5 N NaOH solution for 90 minutes in a constant temperature bath at 60 ^{0}C. After etching the detectors were thoroughly washed and scanned manually for track density measurements using optical microscope at a magnification of 400X. The track density obtained was converted into the units of Bqm^{-3} using the calibration factor [0.020+0.002 track cm^{-2} d^{-1}/ Bqm^{-3}][7].

RESULTS AND DISCUSSION

Twenty locations have been chosen at different villages of Hamirpur district of Himachal Pradesh, India for measurement of Radon with the help of LR-115 film detectors. Table 1: provides the complete information regarding radon concentration, absorbed dose, equivalent dose and effective dose (to lungs) for study area.
Figure 1 shows the radon concentration for twenty locations. At location Mundkhar highest value and at Baru lowest value of radon concentration is recorded. It is concluded from the observations that, the value of radon concentration varies from one dwelling to another. The variation found in the radon concentration of different houses may be due to different ventilation rates, type of building materials used during construction and the variation in the radioactive level in the soil under the houses.

Table 1: Radon concentration, absorbed dose, equivalent dose and effective dose (to lungs) for study area

S. No.	Locations	Radon concentration (Bqm^{-3})	Absorbed dose (mSv/yr)	Equivalent dose (mSv/yr)	Effective dose (mSv/yr)
1	Ramehra	146	1.84	36.83	4.42
2	Bhater	133	1.68	33.55	4.03
3	Baru	47	0.59	11.86	1.42
4	Bassi	86	1.08	21.70	2.60
5	Lambloo	142	1.79	35.82	4.30
6	Ropar	70	0.88	17.66	2.12
7	Kehdru	84	1.06	21.19	2.54
8	Bilkar Runia	81	1.02	20.43	2.45
9	Dungrin	92	1.16	23.21	2.79
10	Sarkaghat	157	1.98	39.61	4.75
11	Mundkhar	215	2.71	54.24	6.51
12	Kharwar	69	0.87	17.41	2.09
13	Sohari	173	2.18	43.64	5.24
14	Chamyog	81	1.03	20.69	2.48
15	Galot	79	1.00	19.93	2.39
16	Jharlog	87	1.10	21.95	2.63
17	Doh	96	1.21	24.22	2.91
18	Amman	72	0.91	18.16	2.18
19	Lathwan	143	1.80	36.08	4.33
20	Lidiyoh	124	1.56	31.28	3.75

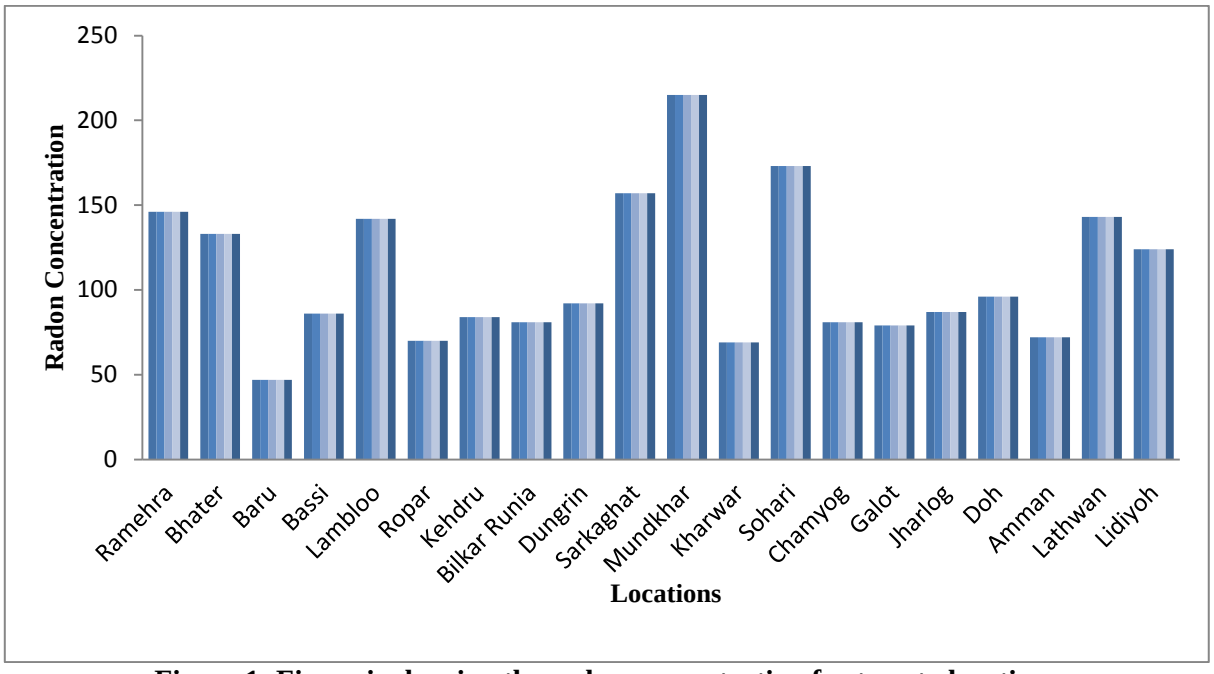

Figure 1: Figure is showing the radon concentration for twenty locations

CONCLUSIONS

1. The radon concentration values measured in the dwellings of Hamirpur district were found in range 47 to 215 Bqm^{-3}.
2. This study shows that the annual effective dose received by the residents in the considered area is in the range of 1.42 to 6.51 mSv/yr. As per recommendation of ICRP

2009, safe effective dose (to lungs) is in the range of 3-10 mSv/yr. From calculations it is prove that the value of effective dose under safe zone.

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