Measurements of Radon Radiations using different dwelling conditions

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Introduction

Nuclear physics not only advances the frontiers of knowledge but also makes remarkable contributions to the need of society such as nuclear radiations and nuclear medicine. Radiations have always been a part of our natural environment. Exposure of ionizing radiation, which cant not been detected by any sense of our body, is injurious to our health. Radon is colorless, chemically inert radioactive element and well known pollutant. It is formed in rocks and the soil where the uranium is present. Three naturally produced isotopes $^{222}Rn(radon)$, $^{220}Rn(thoron)$ and $^{219}Rn(actinon)$. Being radioactive, 222Rn decays with a half-life of 3.82 days and emits alpha particle of energy 5.48 MeV. Therefore measurement of indoor radon and its progeny in human dwelling is very important from the health physics point of view. Worldwide, many investigations have been conducted to determine the exposure to radon and its progeny. The lung cancer risk depends on the effective alpha dose received by lung tissues from inhalation of radon and its decay products [1].

Experimental Measurements

Solid State Nuclear Track Detectors (SSNTDs), is one of the easiest method for the detection of alpha particles emitted from radon and its progeny, protons, neutrons and fission fragments [2]. The LR-115 detector is one of the most commonly used SSNTDs, also used for measurements of indoor ^{222}Rn concentrations. It consists of cellulose nitrate active layer (red layer) on 100m clear polyester base substrate. The thickness of this film is 12μm and the sensitivity depends on the equilibrium factor and thickness of the layer. After the exposure period of 50 and 100 hrs, the detectors were etched for 90 mins in 2.5N NaOH solution maintained at 60^oC in constant temperature bath. At the end of etching, the detectors are removed, washed in distilled water. After drying the detectors are ready to count under an optical microscope for track density measurements.

Results and discussion

The area of study region is NIT, Jalandhar (Pb) India. The LR-115 plastic track detectors having a size of about 1.5 cm x 1.5 cm fixed on micro glass slides were suspended at the center of the room for 50 hours and 100 hours. Six LR-115 films are used, two for poor ventilation (L1 and L2), two for partially ventilation (L3 and L4) and two for high ventilation (L5 and L6). Our assumptions for the present study are that a room with a door without window is poorly ventilated, that with one door and one window as partially ventilated and with more than two windows and a door as well ventilated. Table1., gives the results for the measurement of the average annual radon concentration, life time fatality risk and average annual dose calculated by the use

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TABLE I: Measurement of the Radon concentration, life time fatality risk and average annual dose calculated by the use of LR-115 films.

Detectors	Exposure time (hours)	Conditions	Radon Conccentration (Bqm^{-3})	Life Time Fatality Risk (10^{-4})	Average Annual Dose $(mSv).y^{-1}$
L1	50	Poor Ventilation	130.24	1.72	2.22
L2	100	Poor Ventilation	141.09	1.83	2.41
L3	50	Partially Ventilation	119.39	1.02	1.91
L4	100	Partially Ventilation	125.13	1.56	2.04
L5	50	High Ventilation	65.12	0.86	1.11
L6	100	High Ventilation	97.68	1.29	1.67

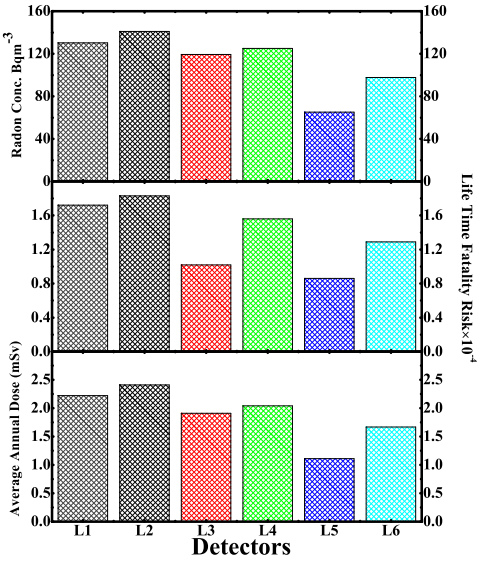

FIG. 1: Measurement of the Radon concentration, life time fatality risk and average annual dose.

of LR-115 films. The value of radon concentration, life time fatality risk and average annual dose is usually low in case of high ventilation rooms. The minimum and maximum value of indoor radon concentration is 65.12 Bqm^{-3} and 130.24 Bqm^{-3} respectively. The international commission on radiation protection (ICRP-65)[3] has recommended that the action level for radon concentration should be in the range 200-300Bqm^{-3}. The measured radon concentration values are below the recommended action level. Average annual dose of these films are vary from 2.22mSv to 1.11mSv.y^{-1} respectively. ICRP, has recommended the annual effective dose equivalent limit from 3 mSv.y^{-1} to 10 mSv.y^{-1}. However these values are below the recommended values. In other word, the average annual dose values are within the safety range. Therefore that region is safe and not much harmful for human being.

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References

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