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SEASONAL VARIATION STUDY OF RADON POLLUTION AT RADIOACTIVE SITES

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ABSTRACT

Radon is posing a deep concern to human life from health-hazard point of view, especially to the uranium mine-workers and people living near the radioactive zones. Exposure of high doses of radon can cause lung cancer to the people. The present investigations are carried out in about 20 domestic places of a radioactive site in Himachal Pradesh, India for a year. The levels of radon activity are found to be quite high, giving an annual exposure-dose that crosses the safety limits set by various agencies. It is found that radon activity increases in winter season in comparison to summer season due to the reduced ventilation. The average values in summer and winter are found to be 977.17 Bq/m^3 and 1174.01 Bq/m^3 respectively, exposing the people to an average annual dose of 47.09 mSv.

KEYWORDS

Radon, uranium, pollution, exposure-dose, lung cancer, LR-115

INTRODUCTION

Radon is one of the daughter products present in the naturally occuring uranium series and is found in traces almost everywhere in the earth. Radon emanates from the earth and diffuses into the nearby atmosphere. Radon and its daughters present in human environment can result a significant risk to the general public. Due to alpha emitting short lived daughters Po^{218} and Po^{214}, it has long been known to be a causative agent for lung cancer when present in high concentration as in uranium mines (Sevc et al., 1976; Evans et al., 1981). These daughter products can attach to the surface of airborne particles and remain airborne for a long time. During respiration they deposit in the lung and irradiate the tissue. Since the majority of peoples' time is spent in homes, there is a growing concern about potential health effects due to indoor radon. To obtain an accurate idea of the radon-related lung cancer incidence, and to plan proper control measures, the population dose has to be estimated.

For the general public the highest contribution to the annual average radiation exposure comes from Rn and its progeny. The commulative effective dose-equivalent, an individual receives each year from low-level sources of all kinds amounts to about 2 mSv, out of which 1.37 mSv is due to radon isotopes and their short-lived progeny (Bulletin of IAEA/PI/A114E, 1988) as illustrated in Fig.1 . Various agencies dealing with the radiation protection field have put forth certain limits to the dose received by the people from radon and its progeny, above which it can be a health-hazardous. The annual dose equivalent limit recommended by ICRP for individual members of the public is 5 mSv.

The present study is an extension of our earlier work (Singh et al., 1989) for the analysis of full year experimental data in twenty houses of Rameda village Himachal Pradesh, India. This area is chosen due to its uranium enrichment. Sand stones, mud and wood has been used in the construction of these houses, the ventilation being of intermediate type with absence of cross-ventilation.

EXPERIMENTAL TECHNIQUE

We have used LR-115 type II film in the bare mode to measure the radon and its daughters. The film consists of a strongly red coloured layer of cellulose nitrate coated on an inert polyster base (100 μm thick). The thickness of the

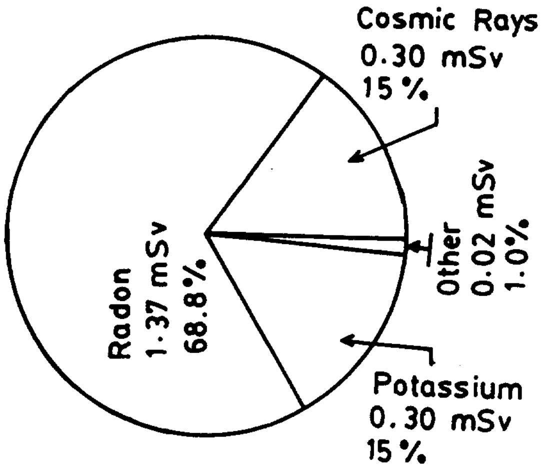

Fig. 1. Natural radiation sources: Annual doses

layer is 12 µm and is suitable to obtain tracks from ambient alpha energies from radon and its daughter products. Plated-out radon daughters cannot produce etchable tracks owing to the low energy limit of etch-hole formation in this detector (Hafez and Somogyi, 1986). The details of experimental procedure have already been given (Singh et al., 1989). These samples were exposed for a period of six months, for the assesment of summer season and were then replaced by the fresh ones to have an exposure again for a period of six months, for the assesment of winter season. The track density obtained was converted into the units of Bq/m^3 using a calibration constant (Suba Ramu et al.,1988) with an equilibrium factor of 0.5 between radon and its progeny.

RESULTS AND DISCUSSION

Our data shows that the radon activity in a room may vary widely from wall to wall which is due to the random distribution of radioactive rock species used ignorantly in the construction of houses. As a result, a person sitting or sleeping near the active site will receive higher dose than the average dose. The radon activity vary widely from house to house also, depending upon the quantity of radioactive material used. The radon activity level is found to be higher in winter than in summer due to poor ventilation in winter. The overall average radon activity found in the summer and winter seasons is 977.17 Bq/m^3 and 1174.01 Bq/m^3 respectively, giving an annual dose of 47.09mSv to the occupants. This level is far exceeding than the levels set by various radiation protection agencies. Some occupants are receiving a dose as high as 100.93 mSv. Such high doses may pose a significant risk from the health hazard point of view. Measures should be taken to reduce these values to the minimum and also in future the construction of houses near the radioactive zones should be discouraged.

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