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MEASUREMENT OF EQUILIBRIUM FACTORS OF RADON AND ITS PROGENY USING SSNTDS IN THE DWELLINGS OF HYDERABAD SURROUNDINGS, INDIA

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ABSTRACT
Equilibrium factors play a significant role in the estimation of effective dose in the dwellings due to Radon and its progeny. Generally, the dose is estimated using UNSCEAR suggested equilibrium factor (EF) of 0.4 for the radon and its progeny. But in practice the concentration of radon and its progeny vary appreciably with local environmental conditions. Hence, the equilibrium factor EF also changes and therefore affects the effective dose estimation of a particular dwelling. So, the UNSCEAR EF value does not reflect the actual effective dose of a dwelling. With this in view, the present study is carried out to estimate the equilibrium factors in different types of dwellings in the surroundings of Hyderabad using SSNTDs. It is found that, the equilibrium factors in the surroundings of Hyderabad vary from 0.01 to 0.64 with an average of 0.31 ± 0.16. The average EF value in the surroundings of Hyderabad is found to be relatively lower than Indian average and global average. This paper presents the reasons for lower EF values in the study area.

Key words: Radon, Progeny, equilibrium factors, dwelling, effective dose, SSNTD.

INTRODUCTION

Radon (^{222}Ra) is an inert noble and most common isotope arises in the radioactive decay chain of Uranium -238 (^{238}U). ^{238}U occurs naturally in varying levels in rocks and soils. Fraction of radon escapes in to air from soil and rocks and so present in the atmosphere. Thus simply breathing by common people and exposed to radiation from radon itself and short lived radon decay products [1]. Since long, radon was recognized as hazard to underground miners. However, while it was also recognized that domestic exposure to might carry a risk. The risk from residential exposure to radon and its decay is of great interest in many countries and a number of countries have already adopted regulatory measures to mitigate radon dose in the existing dwellings.

In the evaluation of effective dose due to radon and its progeny in the dwellings, equilibrium factor (EF) plays a significant role. EF is a measure of the degree of radioactive equilibrium between radon and its short lived radioactive decay products. Generally, the effective dose estimated using the UNSCEAR EF value 0.40 [2]. Though it is a reasonable, but it varies significantly with the type of dwelling and environmental factors. Therefore, to evaluate the effective dose to the people living the dwelling, one has to evaluate the EF value to that dwelling with prevailing environmental conditions.

The present study is an attempt to estimate the EF values using SSNTDs for various types of dwellings in the surrounding areas of Hyderabad. It is important to know the normal range of the EF values for a particular region for effective dose assessment.

Measurement Procedure:

Passive dosimeters were used to estimate the concentration of ^{222}Rn and its progeny in the dwellings of surroundings areas of Hyderabad. The details of dosimeters and its methodology have been already discussed systematically [1, 3]. The dosimeters were installed, at different locations, in different types of dwellings and retrieved in a stipulated time. The exposed films were etched in a standard chemical procedure

[1] and counted the tracks in membrane mode, filter mode and bare mode. The concentrations of radon and its progeny were estimated using the calibration factors.

RESULTS AND DISCUSSION:

The equilibrium factors, EFs, are derived using formula

$$EF_{Rn} = (WL/ R_{cn}) \times 3700,$$

where, WL working level representing the progeny concentration and R_{cn} is the radon concentration. The estimated average EF values of radon in the surrounding areas of Hyderabad are given in table 1. It is found that the EF values in the surrounding areas of Hyderabad vary from 0.01 to 0.64 with an average value of 0.31 ± 0.21, whereas in the Indian dwellings the EF values are ranging from 0.21 to 0.67 with an average value of 0.52 [4]. The average EF value for the dwellings in the surroundings of Hyderabad is lower than the dwellings of Hyderabad EF value is 0.32 [5] and global average of 0.4 [2].

The variation of EF values in the different rooms in the various dwelling is shown in Fig.1. It was found those stores rooms have higher values this may be due to store rooms are not open frequently and are mostly closed. The EF values in the other are rooms not consistent with EF values of Hyderabad [5] since in the villages other rooms have usually moderate ventilation and may be typical living style of villagers.

An attempt also made to estimate the EF values in the different types of dwellings such as RCC, asbestos, tiled. The variation of EF values for different dwellings is given in table.2. Dwellings with RCC have higher EF value compared with asbestos and tiled this due to the good ventilation in the asbestos and tiled dwellings when compared with RCC dwellings. The variation of EF values for different types of dwellings are consistent with dwellings of Hyderabad though the radon and its progeny levels are higher [6]. This variation may be due to spatial and temporal variation of environmental conditions in the surrounding areas of Hyderabad. In addition, there is need to understand the indoor environmental parameters of the dwelling such as ventilation, aerosol concentration, surface deposition, occupation factor while calculation the dose of particular dwelling.

The effective dose estimated using, the UNSCEAR EF value from 0.08 to 1.26 mSy^{-1} with an average of 0.26 ± 0.2 mSy^{-1}, EF value obtained in the present study varied, from 0.01 to 0.96 mSy^{-1} with an average of 0.20 ± 0.16 mSy^{-1}.

Table 1. EF values of radon

	EF- values
Range	0.01 to 0.64
Average	0.31
SD	0.16
GM	0.25

Table 2. EF values for different types of dwellings

Type of dwelling	RCC	Asbestos	Tiled
EF value	0.35	0.20	0.31

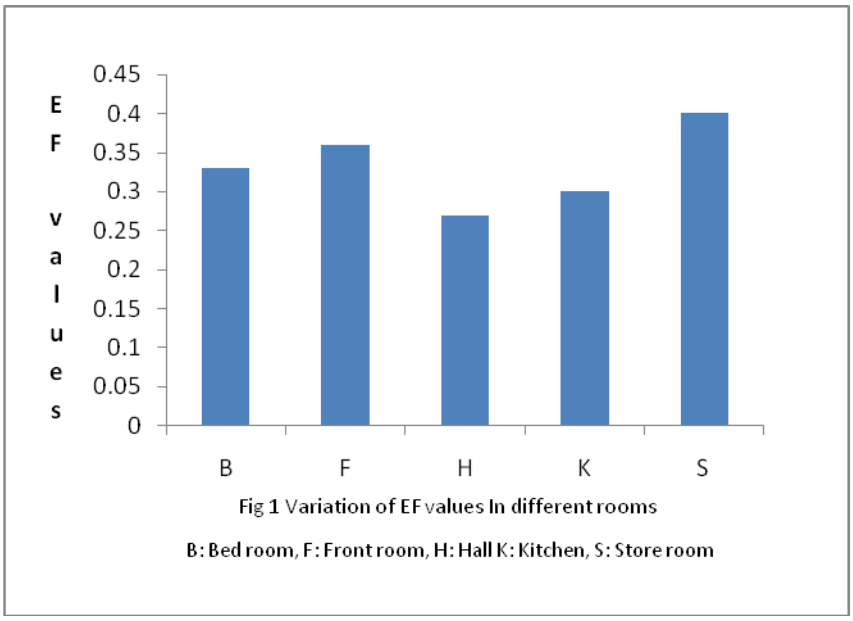

Fig 1 Variation of EF values In different rooms

B: Bed room, F: Front room, H: Hall K: Kitchen, S: Store room

CONCLUSIONS

The average EF values of surrounding areas of Hyderabad are relatively lower than the Hyderabad dwellings. The present study, established that assumed EF values do not reflect the actual condition of dwelling in the evaluation of effective dose. Therefore it is suggested the EF value is to be evaluated for each location with local environmental conditions.

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