

COMPARATIVE RADON MEASUREMENTS

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INTRODUCTION

In the field of radon, there are many types of measurements beside radon concentration in air. There are measurement of radon in soil and water. There is also the measurement of radon exhalation rate and radon dose. This paper will report on the simlutenous measurement of radon concentration in air, radon concentration in soil and radon exhalation rate from soil. The suspicion is that there are corelations among these measurements.

MEASUREMENT

The measurements were taken within the campus of University of Malaya over several days. Beside the radon concentration in the soil, radon concentration in the air and radon exhalation rate from the soil; rainfall and temperature were also taken.

The measurement of radon concentration in air was done by using a continous radon monitor (Sun Nuclear 1027) with silicon detector. The hourly radon concentration was recorded.

Fig. 1 shows the accessory for the measurement of radon exhalation rate. The collection chamber is partially buried in the soil. A constant volume of the chamber above soil was maintained by fixing the soil level on the outside wall of the chamber. The hose from the chamber were connected to a radon detector with AgS sintillation Lucas cell (Scintrex RDA 200). The chamber was first flushed with fresh air. The radon concentration was taken about a n hour later. By assuming the rate of change of radon concentration in the chamber to be equal

to the exhalation rate from the ground minus the decay rate of the radon in the chamber, the radon exhalation rate can be shown to be:

$$n = \frac{N\lambda}{A(1 - e^{-\lambda t})}$$

where n is the radon exhalation rate per unit area of ground surface, N is the measured radon concentration, λ is the radon decay constant, A is the area of soil covered by the collection chamber and t is the time of measurement after the chamber was flushed.

For the measurement of radon concentration in soil and the radon exhalation, the measurement was done using the same radon detector. A probe was sunk about 1 meter into the soil to extract the soil gas for the measurement of radon concentration in soil. The probe is shown in Fig. 2. The soil gas collected was then transferred to the scintillation cell of radon detector for the measurement of current soil radon concentration..

RESULT

Fig. 3 shows the result obtained from a clear sunny day. The curves for soil radon concentration and radon exhalation rate were found to be similar. Their corelation of 0.81 is quite high as shown in Fig. 4. No corelation was found with the radon concentration in air.

However, the strong corelation between the soil radon concentration and radon exhalation rate was lost during rain. Fig. 5 shows the results obtained on a day which rained at about 1:00 pm. Before 1:00 pm, the corelation was still there but this was lost after 1:00 pm. Before 1:00 pm the corelation was 0.87 and after that 0.12.

CONCLUSIONS

There is a strong correlation between soil radon concentration and radon exhalation from the soil on sunny weather. This is expected since the radon in the soil is the source of radon for exhalation. However, this correlation is lost when it rains. Rainwater in the soil would cause change in the movement of radon in the soil while rainwater on the surface would blocked the exhalation of radon.

The radon concentration in air do not show any correlation with soil radon concentration nor radon exhalation rate in any weather condition. This could be due to a high diffusion and dispersion rate once the radon get into the air from the soil.

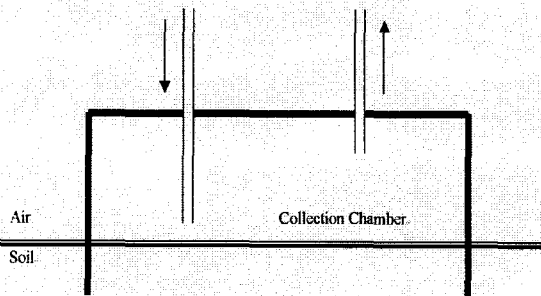


Fig. 1. Soil Radon Exhalation Chamber

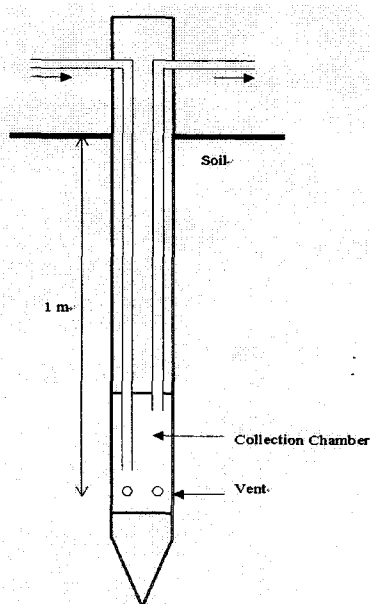


Fig. 2. Soil Radon Probe

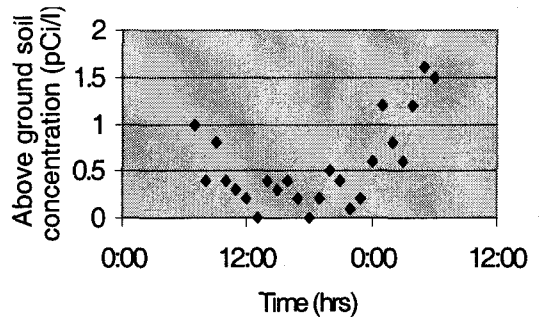
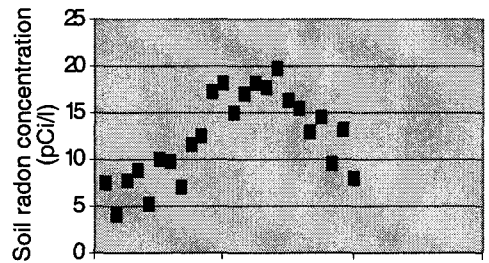
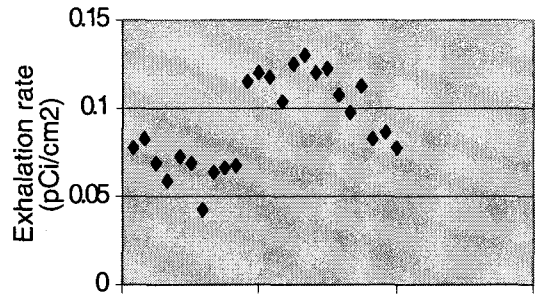


Fig. 3. Measurement done on a clear day

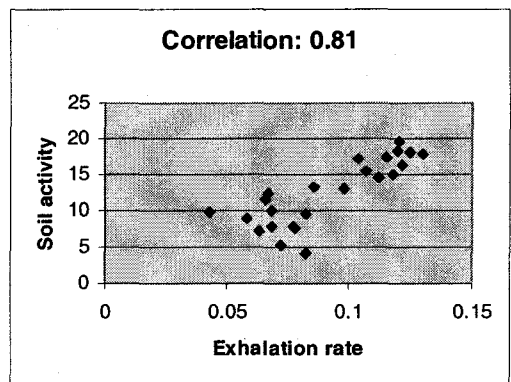


Fig. 4. Correlation between soil radon concentration and soil radon exhalation rate

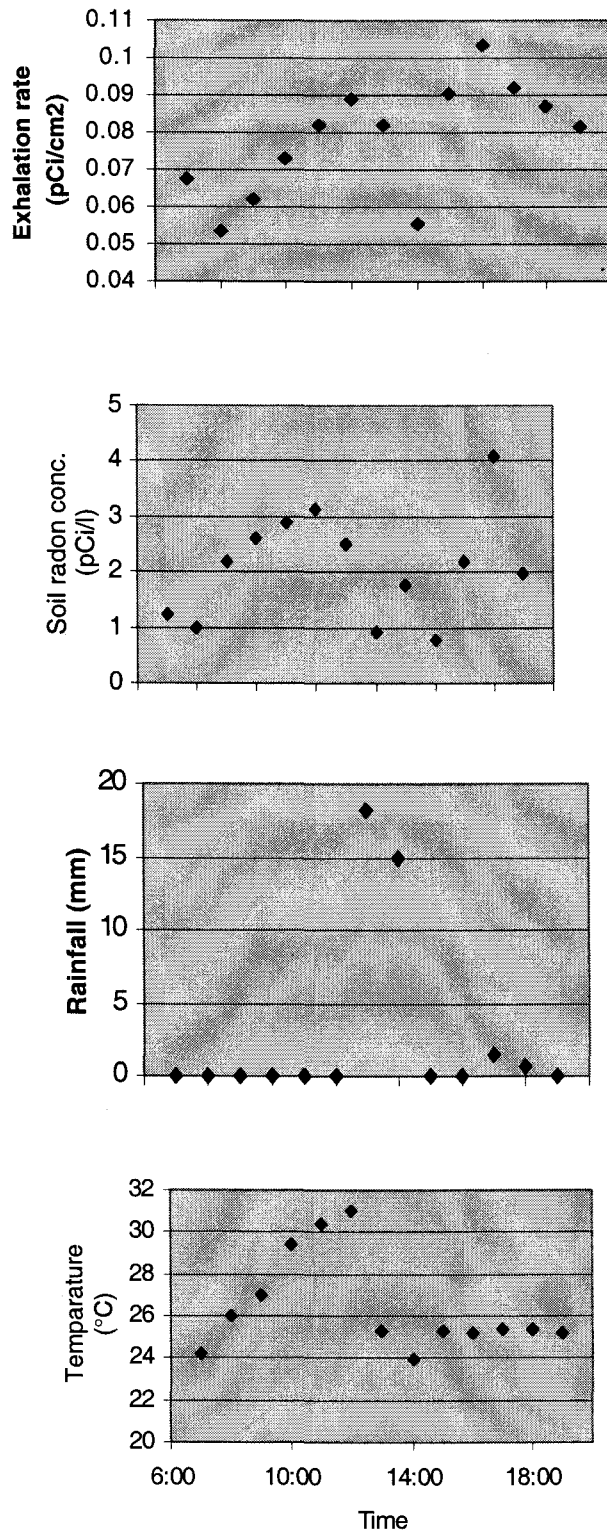


Fig. 5. Measurements done on a day with rain in the afternoon