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Moisture Insensitive Charcoal Canisters

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Continuous monitoring of ^{222}Rn concentrations in the air in houses is the most appropriate approach for the real-time measurments, but this requires complex and expensive instruments and is not practical for large studies. Activated carbon canisters have been used extensively for determining the average concentration over a period of a few days (Geo84). The "open face" charcoal detectors have an integration time constant of about 14 h so that they are sensitive to short-term transient changes in the radon concentration. In addition, water uptake at high relative humidities reduces the radon uptake by the charcoal.

The addition of a diffusion barrier and a nylon screen results in a charcoal detector with an integration half-time ranging from 20 to 60 h and a reduced uptake of water at high humidities (Coh86). Silicone rubber sheeting is relatively permeable to radon and impermeable to water vapor (Jen86). It was the purpose of this study to evaluate the effect of a silicone barrier on the charcoal canister radon collection device.

Experimental Procedure

The standard EPA-style open-face charcoal canisters* were modified by removing the screen and retaining ring. The edges of the screen were smoothed and taped. The filter paper was replaced with a sheet of silicone rubber:** the screen and the retaining ring were then reinserted into the can. The ring was used to seal the silicone rubber against the side of the can except in the area of non-overlap.

Both styles of charcoal canisters were exposed to ^{222}Rn in our Radon Test Chamber at 23°C, and 70% relative humidity for 4 to 7 days. The charcoal canisters were counted on a 4 x 4 NaI(Tl) detector in our underground counting room. A continuous flow of radon-free air is used to purge the 100-cm-thick iron shield. The precision of the results for both styles of charcoal canisters was within counting error. The results obtained for a single four-day exposure is shown in Figure 1. Under these conditions, the uptake and retention of radon by the EPA-style open-face charcoal canister is nearly a factor of 5 greater than that with the rubber membrane. The background counting rate is 207 cpm so that the detection limit (3 sigma) for a 10-m count is 0.1 and 0.5 pCi/L for the open-face and modified charcoal canisters, respectively.

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*Radon Collection Filter, Model RA40V, F and J Specialty Products, Inc., P.O. Box 660065, Miami Springs, FL 33166.

**Silicone rubber sheeting, vulcanized, non-reinforced, 0.005-inch-thick, Cat. # 500-1, Dow Corning, Box 997, Midland, Michigan 48640-4517.

The uptake of water was evaluated by placing both detector types in a 20-L can in which the humidity was maintained at 100%. When tested over a period of 20 days, the uptake of water by the canister with the silicone rubber membrane was about 20% of that by the open-face detector. Additional studies are in process with improved sealing of the membrane to the can.

Acknowledgement

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References

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Geo86 A. C. George, Passive Integrated Measurement of Indoor Radon Using Activated Carbon, Health Phys. Vol. 46, pp. 867-872 (1984).

Jen86 Personal Communication.