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Project Title: Po-210 as Long-Term Integrating Radon Indicator
In the Indoor Environment.

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Research Objective:

The general objective is to improve the knowledge about the transferring processes leading from airborne radon/radon daughters to embedded Po-210 in hard surfaces in the indoor environment. The specific goal of the research is to identify situations in which the surface activity of Po-210 can be used as a long-term indicator of lung cancer risk from past or future radon exposures.

Method:

The faint surface activity of long-lived daughters (Pb-210, Bi-210, Po-210) that radon (Rn-222) leaves behind is difficult to measure in the normal housing stock unless large-area samples are analyzed, preferably by alpha spectrometry of the only alpha emitter in the chain, i.e. Po-210. The only detector able to analyze flat samples larger than say 100 cm² (15 sq in) with high alpha energy resolution is the pulse ionization chamber (PIC). A special PIC for Po-210 spectrometry of semi-infinite samples will be developed. By this detector the sample treatment and measuring times can be kept to a minimum, a few hours in most cases and expensive items can be investigated non-destructively. Initially glass sheets will be the substrate material of choice. The main reason is that glass sheet usually are abundantly available in dwellings. With glass as a substratum room to room variations of the surface activity can be investigated in most cases. Once the surface activity of implanted Pb-210/Po-210 in a glass sheet is determined, the measured value is compared to the cumulated radon/radon daughter exposure of the glass sheet or the corresponding lung cancer risk. One important question to address is if there exist a locality in a dwelling, where the influence from non-dose correlated parameters is small enough for the ingrown Po-210 activity to be useful as lung cancer risk estimator. Laboratory exercises involving plate out experiments under well-controlled conditions will be performed to support the field investigations.

Relevance to Reduction of Risk Uncertainties:

For the radon lung cancer incidence today only past radon exposures are relevant. The only presently known technique for "measuring" cumulated radon levels from the past is based on buildup of long-lived daughter activities in surfaces. Due to its retrospective nature the glass-polonium method has the potential of reducing cancer risk uncertainties as long as the exposure history of the glass sheet is known.

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Scientific Accomplishments:

The development of a PIC for non-destructive alpha spectrometry of large glass sheets (mirrors, windows etc.) has been successful. The new PIC is easy to adapt to field use due to its light weight. The usefulness of window glass as an integrating radon indicator can be questioned. The influence from non-dose correlated parameters (radiators, ventilators, draperies, thermophoresis etc.) are too difficult to control in most cases. The surface polonium content of glass sheets covering photographic frames taken from 16 different houses correlates well ($r=0.8$) with the estimated radon exposure, considering the difficulties in obtaining the true radon exposure values decades back in time

Resulting Publications: None.

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