



## **Radon Emissions from Radium-Dial Watches.**

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Preliminary research during the latter half of 2011 has indicated that significant and potentially hazardous radon concentrations can arise from radium-dial watches stored in the built environment. Radium ( $^{226}\text{Ra}$ ) decays via alpha-particle emission to radon ( $^{222}\text{Rn}$ ); in addition, mesothorium ( $^{228}\text{Ra}$ ) and radiothorium ( $^{228}\text{Th}$ ) were also used in such watches and decay to thoron ( $^{220}\text{Rn}$ ). In the main experiments conducted to date, a set of radium-dial watches representative of a small private collection, was placed in a controlled access room, of volume 67 m<sup>3</sup>, that is continuously ventilated to the external environment. Prior to placing the watches in the room, the radon level at the maximum ventilation rate was ca. 10 Bq/m<sup>3</sup>. This rose to ca. 190-230 Bq/m<sup>3</sup> following the placing of the watches in the room, again under conditions of maximum ventilation. When the ventilation rate decreased to a 'standby' setting, the radon concentration increased rapidly to ca. 2-3 kBq/m<sup>3</sup>, then decreased rapidly to the lower concentration when the ventilation rate returned to maximum. Extrapolation of results of monitoring a single watch under zero-ventilation conditions indicates that the zero-ventilation equilibrium concentration in the room arising from the set of watches exceeds 5 kBq/m<sup>3</sup> and Monte-Carlo simulation indicates this could exceed 10 kBq/m<sup>3</sup>, both of which are greatly in excess of the UK Action Levels. Observation of such levels is largely unreported in the literature and our preliminary conclusion is that whilst collectors might be aware of the radiation hazard that arises directly from the radioactive material content of such watches, they are probably not aware of the large radon (and thoron) hazard that can arise, particularly if the watches are kept in a poorly ventilated room in a private house.