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# Radon emamation measurement in the Israeli Standard 5098 "Control of Natural Radioactive Elements in Building Products"

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## Abstract

The increased tendency to use, due to economical and environmental reasons, recycled industrial by-products containing Natural Occurring Radioactive Materials (NORM) in the building material (BM) industry and the possibly increased exposure caused by them are the driving forces for the development of standards and guidelines. The Israeli Standard 5098 (IS 5098) "Content of natural radioactive elements in building products" was finally approved at its third revision at the end of 2009.

The IS 5098 is one of the few National regulations worldwide including requirements on radon exposure and measurement methods.

The IS 5098 describes in details the procedure for the determination of the radon emanation from a BM sample. The method is based on the measurement of the radon exhaled from the BM using the close chamber method.

The BM should be kept at their original size while for concrete samples they must be 10 x 10 x 20 $cm^3$.

The sample, sealed in all the sides not facing into the room, is located in a sealed chamber having a sealing capability of one air exchange every 1500 hours. Heavy concrete (>2,200 $kg/m^3$) can be measured without sealing the sides however the result should be divided by the empirical correction factor of 1.33.

The radon concentration in the free air volume of the chamber increases with time during the sampling period which should be at least 4 days according to the following equation.

$$C(t) = C(0)e^{-(\lambda_{Rn}+\lambda_v)t} + \frac{SE_0}{(\lambda_{Rn}+\lambda_v)V}(1-e^{-(\lambda_{Rn}+\lambda_v)t})$$

Where C(0) is the laboratory radon concentration at the beginning of the measurement, $\lambda_{Rn}$ and $\lambda_v$ are the radon decay rate and the air exchange rate of the chamber, S is the exhaling surface area, $E_0$ is the exhalation rate and V is the free air volume in the chamber.

The radon concentration can be measured using a continuous radon monitor, a calibrated activated charcoal canister or an electret detector.

The radon emanation rate is then calculated by the following expression $e = \frac{A_{Rn}}{A_{Ra}}$, where $A_{Rn}$ is the radon activity in the air volume of the chamber at equilibrium and $A_{Ra}$ is the $^{226}$Ra activity in the BM sample.