The Exhalation Bed: Facility to calibrate radon flux devices

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The measurement of the quantity of radon concentration exhaled from materials or soils in units of time and surface (exhalation rate or radon flux) can be useful for different purposes such as: i) determining the radon potential of a new building area; ii) monitoring the accomplishments of regulatory requirements in uranium mill tailings or phosphogypsum piles; iii) determining the radon exhalation rate of building materials. In addition, the knowledge of the spatial and temporal variability of terrestrial radon fluxes over the soil is useful for the application of the Radon Tracer Method (RTM), an approach for the indirect estimation of greenhouse gas fluxes.

To perform high quality measurement of radon flux, there is the need to develop a reference system, here defined as Exhalation Bed, where radon flux systems can be calibrated under controlled conditions and then used as transfer standard. This will give the possibility to carry out traceable radon flux measurements in the field and quantify the uncertainty associated.

The current study presents a reference radon exhalation bed designed and built within the EMPIR ENV01 traceRadon project. Two approaches, theoretical and experimental, were applied to determine the radon flux from the exhalation bed facility under environmental standard conditions. The first approach is based on the solution of the theoretical diffusion equation, while the second is the result of the continuous monitoring of the increasing radon concentration within a hermetically closed accumulation chamber. The experimental Exhalation Bed characterization is based on the assumption that the radon emanated from the material within the bed is completely exhaled inside the accumulation chamber. Bothe the cover chamber used for the accumulation as well as the Exhalation Bed container itself are made of stainless steel.

An experimental study of the influence of environmental parameters on radon flux measurements will be carried out using a radon Autoflux system from the Australia's Nuclear Science and Technology Organisation (ANSTO). The main environmental conditions varied

during the calibration study will be temperature, air pressure, wind and soil humidity. Then, a calibration protocol will be developed using input from the tests.

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