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traceRadon project: new radon metrology at the environmental level for use in climate change observation and radiation protection

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Overview on Radon

Radon (²²²Rn) is part of the natural decay chain of ²³⁸U and originates directly from the decay of ²²⁶Ra, practically ubiquitous in rocks and soils. Radon reaches the outdoor environment mainly by exhaling from the soil and is quickly diluted in air. Typical atmospheric radon (or also called outdoor radon) concentration ranges between 1 Bq·m⁻³ and 100 Bq·m⁻³. Due to its radioactive decay (T_{1/2} \approx 3.8 d), it tends to accumulate in building reaching elevated concentration in indoor air (up to thousands Bq·m⁻³) representing a health hazard for the inhabitants.

Soil or residue surface

Source: EANR, 2009

Rn exhalatio



Public exposure to natural radiation



Among the natural sources of ionizing radiation, it is responsible for half of the natural dose received by the global population (UNSCEAR, 2008) and is a major cause of lung cancer after smoking (WHO, 2009).

Atmospheric radon and radon flux

Although, atmospheric radon does not represent a significant health risk to the general population, it plays important roles in scientific research. It is used in different scientific disciplines (Celikovic, 2021), together with radon flux, some examples are:

- <figure>
- a) as a tracer to improve atmospheric transport models (Chambers et al., 2015; Vargas et al., 2015)
 b) to indirectly estimate greenhouse gas (GHG) fluxes using the Radon Tracer Method (RTM) (Levin et al., 2021; Grossi et al., 2018).
 - c) to improve the estimation of Radon Priority Areas (RPA), areas where the radon concentration (as an annual average) in a significant number of buildings is expected to exceed the relevant national reference level (EU-BSS).
 - d) to characterize radon wash-out peaks in the ambient dose rate data, which are exchanged in



So, it is important to reduce radon exposure and hence cancer risk (https://www.cancer.eu/cancer-preventionthe-european-code-against-cancer/). Indeed, council Directive 2013/59/EURATOM (EU-BSS) (EU, 2013) contains detailed provisions on the protection from all natural radiation sources, including radon. According to this directive, EU member states are obliged to develop a Radon Action Plan to address long-term risks from radon in dwellings, buildings with public access and workplaces.



the EURDEP early warning system for radiological/nuclear accidents (https://remon.jrc.ec.europa.eu/About/Rad-Data-Exchange).

An overlapping need exists between the climate research and radiation protection communities for improved traceable low-level radon activity concentration (²²²Rn) and radon flux measurements, combining the challenges of collecting, collating and modelling large datasets, with setting up new radiation protection services.

The **EMPIR project 19ENV01 traceRadon** serves the purpose to establish a metrological base which supports environmental outdoor radon measurements for the use in climate observation and in radiation protection for the public.







WP6

Seven leading European NMI/DI in the field of climate observation and ionising radiation. ICOS, JRC and other stakeholders directly involved as JRP-partners. Sufficient further external partners with high-level expertise to cover the broad spectrum of two scientific communities. High interest by stakeholder community, expressed by 65 letters of support and a large group of 34 potential collaborators.

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+ 16 collaborators

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