

The study “**Two new ²²²Rn emanation sources – a comparison study**” by Balle et al. presents a comparison of two new ²²²Rn emanation sources using identical reference instrument at distinct sites: PTB and CMI. The findings revealed varying calibration factors, although they fall well within the targeted uncertainty of 10% (k=1). These sources play a crucial role in addressing a significant gap in traceability for both the radiation protection and climate monitoring communities. They demonstrate the fundamental capability to measure ²²²Rn activity concentrations below the 100 Bq m⁻³, with uncertainty of 10% (k=1). Achieving these uncertainties contributes on establishment of traceability to the International System of Units (SI).

My comments are below:

Introduction: *The introduction is well-written; however, I recommend emphasizing the significance of these two sources for both the radiation protection and climate communities. While the importance in terms of radiation protection is evident, it's essential to also clarify its relevance to the climate community, which is currently missing.*

Also, it is missing a short description or reference on current calibration sources.

Line 45: “²²²Rn activity concentration in air depends on a multitude of factors, like the Uranium concentration in soil, the temperature and soil permeability...” – *I would say that atmospheric radon concentration depends mostly on the atmospheric process (ref: Chambers et al., Kikaj et al.,)*

Line 41-48: *I would restructure this section to emphasize the primary purpose of outdoor radon measurements (as a tracer for the atmosphere). Additionally, it's important to highlight that there are ongoing atmospheric radon measurements at the ICOS stations and how these measurements would complement and benefit from the new emanation sources.*

Line 23: ...and part of the (*uranium*) ²³⁸U-decay chain.

Line 25: “Approximately 3 % to 14 % of all lung cancer deaths are attributed to the exposure of radiation from ²²²Rn (progenies), depending on the activity concentration of ²²²Rn in a certain area” – *please add a reference.*

Line 29: “Additionally, the identification of RPAs is a major aim of the EU EMPIR project 19ENV01” **suggestion:** *Identification of the RPAs is a one of key objective of the EU EMPIR*

Line 30-33: “The project results will be implemented to identify RPAs, which is required by European Council Directive 2013/59/EURATOM, which in turn will help decision makers to enforce the respective ²²²Rn action plans of the EU member states and improve radiation protection of the general public (Röttger et al., 2021).”

Suggestions: *The project's outcomes will be utilized to fulfil the requirement set by the European Council Directive 2013/59/EURATOM, thereby enabling decision-makers to enforce ²²²Rn action plans within EU member states and enhance radiation protection for the general public (Röttger et al., 2021).*

Line 34-35: “In the framework of the International Carbon Observation System (ICOS) the European commission Joint Research Center (JRC) has published a map of Europe, presenting indoor ²²²Rn measurements as 35 early as 2006 (accessible at <https://remap.jrc.ec.europa.eu/Atlas.aspx#> accessed...).” – *What is the connection between ICOS and radioactivity monitoring? Is this a typo?*

Line 56-57: “Integrated Radon Source Detector (IRSD)...” - from whom is developed this source? Since you have mentioned that CMI is developed from Czech...

2. Measurements at PTB, Set up & Results

I would need a bit more clarification here:

- *The Figure 1 (is IRSD #1 and RRI#1 in diffusion mode and 50L) and Figure 2 (IRSD #2; RRI#2 and 500 L in what type: diffusion/flow?) I'm particularly confused by the denser point measurements in Figure 1 compared to Figure 2. Could you please provide more clarity on this matter?*
- *Could you please ensure that the captions for Figure 1 and Figure 2 are consistent and harmonized? Perhaps you could consider including a legend in both figures to explain what blue line and grey points means, as well as indicating the specific experiment they represent?"*
- *Is there any difference between IRSD #1 and #2. Additionally, would it be more coherent to include Tables 1 and 2 in Section 2 for easier understanding? Alternatively, placing a separate section at the beginning of section 2 with a brief description of the sources (as it is in 3.4) in my opinion might enhance clarity.*