





Calibration of novel transfer standards with new ²²²Rn emanation sources

EMPIR 19ENV01 traceRadon













Introduction

The traceRadon project













Journal of Geophysical Research: Atmospheres **104** (1999) 1998JD100064





The traceRadon project













Transfer Standards and calibration source

ARMON, ANSTO and IRSD





- Operation principle: Electrostatic collection of ²¹⁸Po and ²¹⁶Po from ²²²Rn and ²²⁰Rn respectively on an alpha detector
- Designed, built and calibrated at the INTE-UPC (radon chamber)



ARMON v1.0 Grossi et al. (2012) Vargas et al. (2025)

This project 19ENV01 traceRadon has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme. **19ENV01 traceRadon** denotes the EMPIR project reference.



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Rado

Australian Nuclear Science and Technology Organization (ANSTO)

Mains Power **Electronics Enclosure** (110 - 240 V AC) Control PC Flow meter 0.40 m Calibration Data Logger Unit High voltage / Discriminator Exhaust 🔫 Shut off valve Absolute Pressure Photomultiplier Second filter Temp. / Humidity 200 L main 0.85 m Detector sample delay. measurement volume head Flow Homogenising Flow sensor Screen Internal Blower **Primary Filter** 0.40 m ← Inlet Thoron delay External Blower volume



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Advances in Geosciences **57** (2022) 63 - 80

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Physikalisch-Technische Bundesanstalt

National Metrology Institute

10 -1

10 -2

10⁻³

10-4

1000

2000

²²²Rn

α







- Goal: Improve ²²²Rn activity concentration measurements in the range 1 100 Bq/m³
- Method: Develop new calibration standards
- Result: New transfer standards and new primary standards









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Further information on traceRadon



9:00 Low Level Radioactivity Measurement Techniques (LL) - Chairs: B. Quintana Arnés 9:00 Paul Malfrait, IRSN, France 0-89 Online analysis of gamma-ray spectrum by spectral unmixing 0-108 9:20 Begoña Quintana, Univ. of Salamanca, Spain 0-108 Low-level activity determination of ¹⁴ C from marine shells by the CIEMAT/NIST method 0-108 9:40 Iolanda Osvath, IAEA, Marine Env. Laboratories, Monaco 0-106 Improvements in the detection capability for monitoring low levels of radionuclides 0-106 Posters Overview: LL - Chairs: B. Quintana Arnés 9-23 Radon metrology for use in climate change observation and radiation protection at the environmental level P-23 Metrology for the harmonisation of measurements of environmental pollutants in Europe Mirela Vasile, SCK CEN, Belgium P-45 A comparison of different approaches for the analysis of ³⁴ Cl in graphite samples P-73 Estimation of Correction Factors for RadonEye Continuous Radon Monitors P-73 Tomislav Illevski, RBI, Croatia P-73 P-85 Upgrade of HPGe spectrometry system for low level activity determination with cosmic veto P-104 Algorithms development for low level radioxenon spectrum analysis 10-104 P-104 Algorithms development for low level radioxenon spe			
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Thank you for your attention!









traceRadon-project stakeholder committee, stakeholders, MSU, EURAMET

Acknowledgements

✤ traceRadon-project collaborators:



traceRadon-project partners:









Backup







CMI-source











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CMI-source





Steady state:

 $C = \frac{\eta_{Rn}}{Q \cdot \frac{M \cdot p_{cali} \cdot R \cdot T_{con}}{M \cdot p_{con} \cdot R \cdot T_{cali}} + \lambda_{Rn} \cdot V}$

C: Radon activity concentration η_{Rn} : Radon emanation power Q: flow rate M: molar mass R: molar gas constant p_{con} : air pressure p_{Cali} : 1013.25 hPa T_{con} : temperature T_{cali} : 273.16 K λ_{Rn} : Rn decay constant V: Volume of the Rn chamber



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Results











	CMI source		PTB IRSD system		
	k _{cmi}	<i>C</i> (Bq⋅m⁻³)	k _{IRSD}	<i>C</i> (Bq·m⁻³)	$k_{\rm IRSD}/k_{\rm CMI}$
RRI #1	1.056 ± 0.019	21547	1.019 ± 0.015	1925	0.965
RRI #2	1.022 ± 0.017	1605	0.981 ± 0.015	56.3	0.960

RRI: Radon Reference Instrument

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