The History of Radon Calibration in the Czech Republic
National Institute for NBC Protection
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What we measure?

You measure radon! (RnDP are not in soil air)
Purpose of measuring and calibration

- Geological structure in CR → high indoor $^{222}\text{Rn}$ concentration
- Czech law requires measuring of $^{222}\text{Rn}$ „in soil“ → many measuring companies in CR
- Supervision of whole process – State Office for Nuclear Safety (SONS) provides the permission for measuring only in the case that devices have been verified
- Following parts of this paper are mostly relevant for radon-in-soil measurement; the other types are omitted
**Prehistory** of radon metrology

- Radon metrology is known at least for one century
- First certificate about amount of radium
- The decades of radon measuring devices calibration has started
Radon metrology after 1970

And before 1989

- Many measurements in mines
- Cooperation between socialist countries
- Intercomparison measurement
State after 1989

- Our institute build second RAC (duplicate the chambre in Razés, FR) → radon metrology was settled in the CR

- Traceability of our Lucas chambers:
  - NRPB Chilton (UK)
  - VNIIFTRI Mendeleyevo (Rus)
  - Universiteit Gent (BG)
  - EML (NY)

- Era of mutual comparisons – some methods have been extended:
  - 40 ml glas bulbs with defined amount of Rn-222 (NPL Teddington, UK)
  - International intercomparisons (Badgastein, Pribram, US mines and labs)
  - PTB Braunschweig – sending of AlphaGuard
  - PAMI 96
Current state - circumstances

- Authorized Metrologic Center for radon-222 (AMC) and accredited Calibration Laboratory (CL)
- Organizations have to verify their devices every two years (difference from AMC less than 20 % = OK)
- AMC issued about 5000 verification sheets
- Assistance for the CMI (Czech Metrological Institute) in the process of type approval of new radon or radon decay monitors
- Traceability to eminent laborotories abroad
Current state - traceability

„transfer standard“
Quality Assurance

- Authorized by the Czech Office for Standards, Metrology and Testing
- Accredited by the Czech Accreditation Institute
- Certified by Lloyd’s Register Quality Assurance
The calibration process of radon-in-soil devices

- 2 - 5 kBq·m⁻³
- 45 - 80 kBq·m⁻³
- 90 - 135 kBq·m⁻³
- 30 - 50 kBq·m⁻³
Radon-Aerosol Chamber (RAC)

Walk-in RAC (Volume: 10 m³)
Radon-222 measurements (highest metrological level)

→ Grab sampling

→ Continual monitoring
The best world primary radon measurement (PTB)?


Radon is deposited to „point“ circle at 25 K, and its activity is measured at precisely defined detection geometry. Radon is transported to the bulb after measurement, and then a secondary system could be applied – gamma measurement of this 40 ml bulb. Together, both systems provide a reliable tool for the production of gaseous $^{222}$Rn activity standards with relative uncertainties of less than 1%. 

![Diagram of radon measurement setup](image-url)
Thanks for your attention!

http://www.metroradon.eu

ACKNOWLEDGEMENT: This presentation was created under the project MetroRADON within the European Metrology Programme for Innovation and Research (EMPIR)