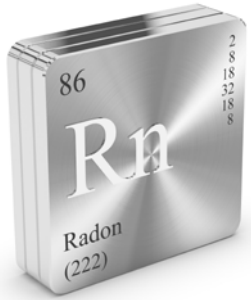
HOW TO MEASURE RADON GAS: ISO STANDARDS

GRUPO RADON



- Radon is …….

No more repetitions on what radon is. We all know

TOOLS

IAEA Safety Standards

for protecting people and the environment

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

TOOLS

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Contents

TOOLS

ISO standards to help manage risk of exposure to radon

A new series of ISO standards on radon measurement in the environment and buildings will help to assess the radiation exposure to natural radioactivity in the environment and buildings, particularly radon, which is considered the second cause of lung cancer after smoking in many countries and is reported by the World Health Organization (WHO) to cause between 3 -14% of such diseases worldwide

PROJECT LEADER: Roselyne Ameon (IRSN, France)

•Part 1: Origins of radon and its short-lived decay products and associated measurement methods

•Part 2: Integrated measurement method for determining average potential alpha energy concentration of its short-lived decay products

•Part 3: Spot measurement method of the potential alpha energy concentration of its short-lived decay products

•Part 4: Integrated measurement method for determining average activity concentration using passive sampling and delayed analysis

•Part 5: Continuous measurement method of the activity concentration

•Part 6: Spot measurement method of the activity concentration

•Part 7: Accumulation method for estimating surface exhalation rate

•Part 8: Methodologies for initial and additional investigations in buildings Part 9: Method for determining exhalation rate of dense building materials

Part 10: Determination of diffusion coefficient in waterproof materials using activity concentration measurement

Part 11: Test method for soil gaz.

150/DTS 11665-12

Measurement of radioactivity in the environment -- Air : radon 222 – Part 12: Determination of the diffusion coefficient in waterproof materials: membrane one-side activity concentration measurement method

150/TS 11665-13:2017 Pre\1ew

Measurement of radioactivity in the environment -- Air: radon 222 -- Part 13: Determination of the diffusion coefficient in waterproof materials: membrane two-side activity concentration test method

ISO 13164-1:2013 ® Preview

Water quality -- Radon-222 -- Part 1: General principles

ISQ 13164-2:2013 ® Preview

Water quality -- Radon-222 -- Part 2: Test method using gamma-ray spectrometry

ISO 13164-3:2013 ® Preview

Water quality -- Radon-222 -- Part 3: Test method using emanometry

ISQ 13164-4:2015 Preview

Water quality -- Radon-222 -- Part 4: Test method using two-phase liquid scintillation counting

ISQ 13165-1:2013 Preview

Water quality -- Radium-226 -- Part 1: Test method using liquid scintillation counting

TODAY

ISO 11665-7:2012 ® Priew

Measurement of radioactivity in the environment -- Air: radon-222 -- Part 7: Accumulation method for estimating surface exhalation rate

ISO 11665-11:2016 ® Preview

Measurement of radioactivity in the environment -- Air: radon-222 -- Part 11: Test method for soil gas with sampling at depth

ISQ 11665-7:2012 ® Preview

Measurement of radioactivity in the environment -- Air: radon-222 -- Part 7: Accumulation method for estimating surface exhalation rate

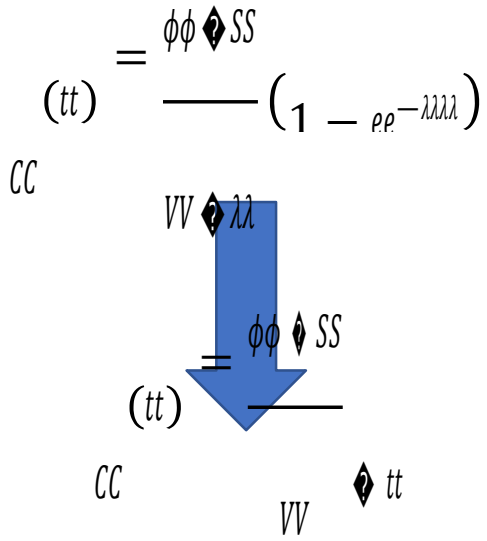
SCOPE

This part of ISO 11665 gives guidelines for estimating the radon-222 surface exhalation rate over a short period (a few hours), at a given place, at the interface of the medium (soil, rock, laid building material, walls, etc.) and the atmosphere. This estimation is based on measuring the radon activity concentration emanating from the surface under investigation and accumulated in a container of a known volume for a known duration.

PRINCIPLE

- Radon accumulation inside a chamber without radon. Chamber is in contact with the surface to be investigated
- Measurement of radon activity concentration in air
- Calculation of exhalation surface rate
- Study of evolution of radon activity concentration in the accumulation chamber

SOME EQUATIONS



EQUIPMENT

- Accumulation chamber
- System to take air samples
- Measuring device to measure radon in air

SAMPLING

- DO NOT ALTER THE ACCUMULATION
- Grab sampling: ISO 11665-6
- Continuous sampling: Active or diffusion (ISO 11665-5)
- Sampling time: it will depend on the measuring system
- Volume of air sampled: it will depend on the measuring method (ISO 11665-5 and ISO 11665-6)

INFLUENCE QUANTITIES

- Accumulation: accumulation chamber; pressure, temperature and humidity; **leakages**
- Measuring radon activity concentration: ISO 11665-5 (continuous) and ISO 11665-6 (grab sampling)

RESULTS: Radon surface exhalation rate

Standard uncertainty

Decision threshold and detection limit

Limits of confidence interval

PRACTICAL EXAMPLES

1. Estimation of radon surface exhalation rate using continuous method
2. Estimation of radon surface exhalation rate by using activated charcoal

ISO 11665-11:2016

Preview

Measurement of radioactivity in the environment -- Air: radon-222 -- Part 11: Test method for soil gas with sampling at depth

SCOPE

This part of ISO 11665 describes radon-222 test methods for soil gas using passive and active in-situ sampling at depth comprised between surface and 2 m.

This part of ISO 11665 gives general requirements for the sampling techniques, either passive or active and grab or continuous, for in-situ radon-222 activity concentrations measurement in soil gas.

The radon-222 activity concentration in the soil can be measured by spot or continuous measurement methods (see ISO 11665-1). In case of spot measurement methods (ISO 11665-6), the soil gas sampling is active only. On the other hand, the continuous methods (ISO 11665-5) are typically associated with passive soil gas sampling

PRINCIPLE

- **Active soil gas sampling**
  - sampling of a volume of soil gas representative of the soil under investigation at time, t, or during time interval Δt
  - transfer of the soil gas sample into the detection chamber
  - measurement of the physical variable
- **Passive soil gas sampling**
  - placing of the detection chamber to the place below the ground surface representative of the soil under investigation during time interval *Δ*t
  - passive transfer of the soil gas sample into the detection chamber by diffusion
  - measurement of the physical variable

EQUIPMENT

- Soil-gas sampling probe
- Device for placing the detection chamber to the chosen place below the ground surface if a passive sampling is use
- Detection chamber
- Measuring system adapted to the physical quantity

INFLUENCE QUANTITIES

- Uncertainty associated with the determination of the real sampling depth (depth interval) below the ground surface
- Soil characteristics
- Instrumental background
- Meteorological parameters

CALIBRATION

No calibration facility for a calibration of the entire system (sampling system and measurement device) is available

calibration of measurement devices for the measurement of radon-222 activity concentration in air

field inter-comparison measurements (exercises)

Thank you very much for your patience