

The measurement of radon in the environment: publication of a new ISO standard

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Radon-222 is considered as the main source of exposure of the public to natural radiation contributing up to 52% of the total internal dose. The radiological exposure of the public is assessed using measurements of Rn activity concentration in the various environmental compartments. The credibility of such assessment relies on the quality of Rn measurement data including the sample representativity of the radiological conditions.

The recent expansion from national stakeholders to a regional and world wide perspective requires that the measurement results obtained on environmental samples in any State are reliable and reproducible to be compared to similar data from any other parts of the world. The standard-setting approach, based on mature test method reviewed by international experts in the field, seemed to lend itself to a settlement of technical aspects of potential data comparison.

In 2007, the members of the ISO Technical Committee 85 on Nuclear energy, nuclear technologies, and radiological protection agreed that the drafting of a standard on the measurement of the activity concentration of Rn and its short-lived decay products in the atmosphere (ISO 11665) was of global relevance and appropriate to the relevant sectors and stakeholders.

Published in 2012, the 8 first part of ISO 11665 standard provide to the laboratories in charge of Rn monitoring the technical requirements based on consensus and agreed at the international levels to assess properly the activity concentration of Rn-222 and its short-lived decay products in the atmosphere.

ISO 13165: A new international standard

Rn activity concentrations in air sampled above continental areas vary over five orders of magnitude, from a few becquerels per cubic metre to several thousand becquerels per cubic metre. The Rn activity concentration as well as the potential alpha energy concentration of its decay products vary tremendously during the day time, from day to day, during the seasons. More than one order of magnitude variation can be observed over short period of time at the same place and thus measurement result will depend on the sampling duration which may extend from a few minutes to several months as well as the season of the sampling date. It is therefore important that the choice of the sampling method, duration and season of sampling are compatible with the intended use of the data as well as the level of the associated uncertainty.

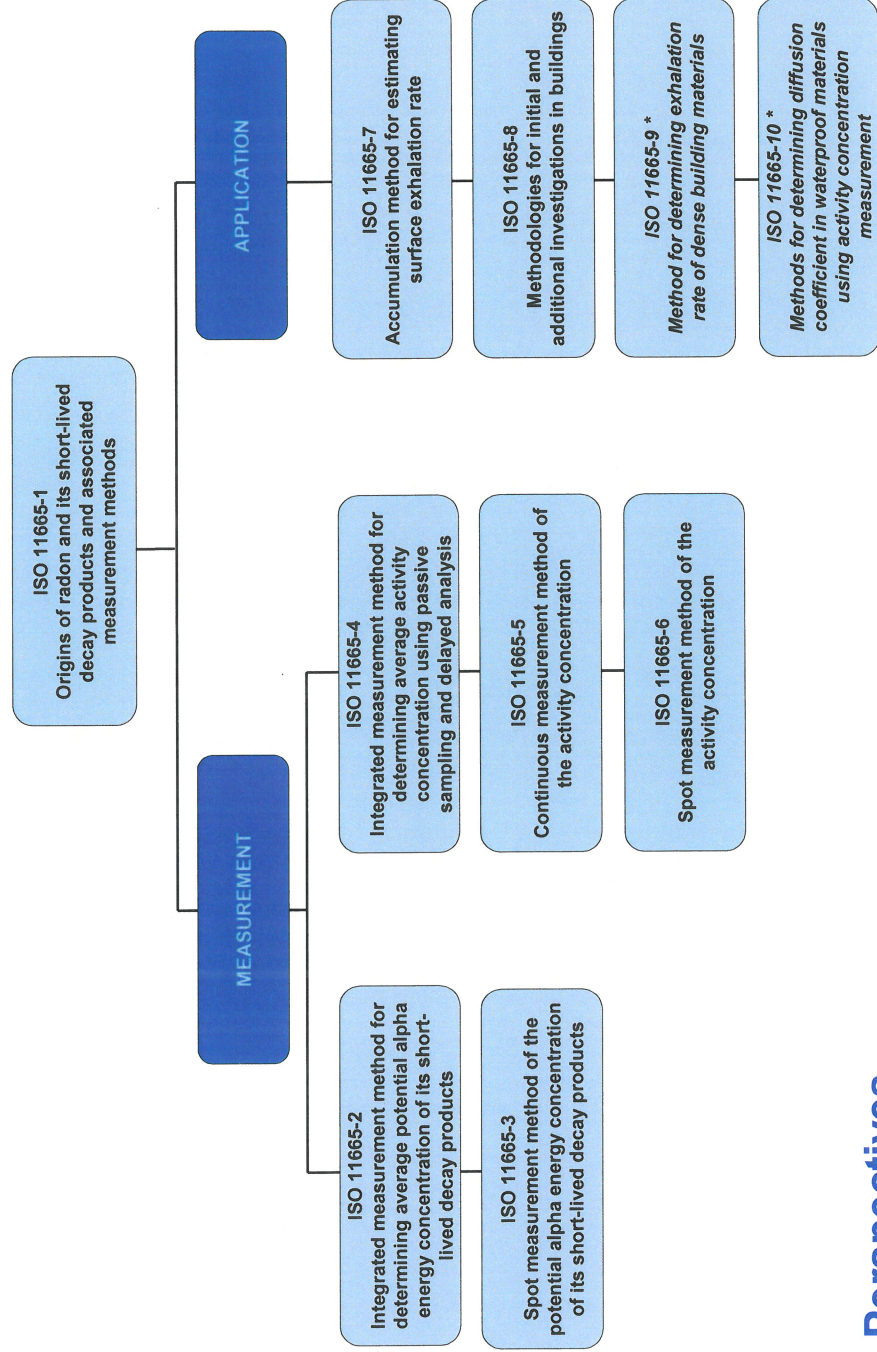
ISO 11665, organized in 10 parts, gives the general guidelines for sampling and describes the test methods for measuring Rn and its decay products in indoor and outdoor environments.

Depending on the duration of the sampling phase, 3 types of measurement methods are distinguished:

- ❖ Spot measurement method that gives indications, at the scale of a few minutes at a given point, on the Rn activity concentration or the potential alpha energy concentration of short-lived Rn decay products in open and confined atmospheres (ISO 11665-3 and ISO 11665-6);
- ❖ Continuous measurement method that allows the assessment of temporal changes in Rn activity concentration in the environment, in public buildings, homes and workplaces, as a function of ventilation and/or meteorological conditions (ISO 11665-5)
- ❖ Integrated measurement method that gives indications on the average Rn activity concentration or on the average potential alpha energy concentration of its short-lived decay products in the air over periods varying from a few days to one year. Application of long-term integrated measurement methods is the appropriate way to assess the human exposure to Rn and its decay products (ISO 11665-2 and ISO 11665-4).

On the basis of the first 6 parts of ISO 11665 dealing with the measurement methods, 4 application standards were drafted:

- ❖ Three of them concern the characterization of the release of Rn in the atmosphere from building materials (ISO 11665-9*) or from soils, rocks, building interfaces in the field of on-site investigations (ISO 11665-7) and the determination of the diffusion coefficient of Rn in waterproof materials (ISO 11665-10*);
- ❖ According to the recommendations of WHO on the need of standardized indoor radon protocols to ensure accurate and consistent measurements, WG17 members drafted ISO 11665-8 which is of particular interest in risk management. This standard covers the applicable requirements to determine the annual average Rn activity concentration in a building and to identify the source and transfer paths of the Rn in this building.
- ❖ These requirements apply also to the effectiveness control and the sustainability of remedial actions.



Perspectives

In 2011, the drafting of a new part of ISO 11665 dealing with the measurement of Rn in soil has been submitted for approval by TC85 State members. In addition to the measurement of Rn in indoor air, the measurement in the soil is used for the drawing up of Rn potential maps. This mapping is a convenient approach for managers in charge of assessing the Rn risk all over a country by defining Rn prone area in which measurement has to be performed or remedial actions have to be implemented.

Even if the Rn-222 contribution (48%) to the global average exposure to natural radiation is far more significant than that of Rn-220 (4%), the measurement of thoron can be of particular interest in some places using building materials with enhanced level of thorium. In recent years, environmental surveys are more and more commissioned to assess the thoron exposure of the public. ISO 16641 covering the requirements for measuring the Rn-220 is currently under elaboration.

* Under elaboration