RADIOAKTIIVSUSE MÕÕTMINE KESKKONNAS
Õhk: radoon-222
Osa 4: Integreeritud mõõtemeetod keskmise aktiivsuskontsentratsiooni määramiseks passiivse proovivõtu ja hilisema analüüsi kasutamisega

Measurement of radioactivity in the environment
Air: Radon 222
Part 4: Integrated measurement method for determining average activity concentration using passive sampling and delayed analysis
(ISO 11665-4:2012)

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

See Eesti standard EVS-ISO 11665-4:2014 „Radioaktiivsuse mõõtmine keskkonnas. Õhk: radoon-222. Osa 4: Integreeritud mõõtemeetod keskmise aktiivsuskontsentratsiooni määramiseks passiivse proovivõtu ja hilisema analüüsi kasutamisega“ sisaldab rahvusvahelise standardi ISO 11665-4:2012 „Measurement of radioactivity in the environment – Air: radon-222 – Part 4: Integrated measurement method for determining average activity concentration using passive sampling and delayed analysis“ identset ingliskeelset teksti.

Ettepaneku rahvusvahelise standardi ümbertrüki meetodil ülevõtuks on esitanud EVS/TK 28, standardi avaldamist on korraldanud Eesti Standardikeskus.

Standard EVS-ISO 11665-4:2014 on jõustunud selle-kohase teate avaldamisega EVS Teataja 2014. aasta detsembrikuu numbris.

Standard on kättesaadav Eesti Standardikeskusest.

NATIONAL FOREWORD

This Estonian Standard EVS-ISO 11665-4:2014 consists of the identical English text of the International Standard ISO 11665-4:2012 „Measurement of radioactivity in the environment – Air: radon-222 – Part 4: Integrated measurement method for determining average activity concentration using passive sampling and delayed analysis“.

Proposal to adopt the International Standard by reprint method has been presented by EVS/TK 28, the Estonian standard has been published by the Estonian Centre for Standardisation.

This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.

The standard is available from the Estonian Centre for Standardisation.

Käsitlusala

Standardi ISO 11665 selles osas kirjeldatakse radoon-222 integreeritud mõõtmismeetodeid passiivse mõõtmis-viisiga. Antakse juhised õhus sisalduva radoon-222 keskmise aktiivsuskontsentratsiooni määramiseks mõõtmistega, mis põhinevad lihtsasti kasutataval ja mittekulukal passiivsel mõõtmisviisil, samuti antakse sensori kasutamise tingimused.

Standardi see osa hõlmab proove, mis on katkematult võetud ajavahemikul paarist päevast ühe aastani.

Antud mõõtmismeetod on kohaldatav õhuproovide suhtes, mille radooni aktiivsuskontsentratsioon on suurem kui 5 Bq/m^3.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11665-4 was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 2, *Radiological protection*.

ISO 11665 consists of the following parts, under the general title *Measurement of radioactivity in the environment — Air: radon-222*:

— *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*

The following parts are under preparation:

— *Part 9: Method for determining exhalation rate of dense building materials*

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

Introduction

Radon isotopes 222, 220 and 219 are radioactive gases produced by the disintegration of radium isotopes 226, 224 and 223, which are decay products of uranium-238, thorium-232 and uranium-235 respectively, and are all found in the earth's crust. Solid elements, also radioactive, followed by stable lead are produced by radon disintegration[1].

When disintegrating, radon emits alpha particles and generates solid decay products, which are also radioactive (polonium, bismuth, lead, etc.). The potential effects on human health of radon lie in its solid decay products rather than the gas itself. Whether or not they are attached to atmospheric aerosols, radon decay products can be inhaled and deposited in the bronchopulmonary tree to varying depths according to their size.

Radon is today considered to be the main source of human exposure to natural radiation. The UNSCEAR (2006) report[2] suggests that, at the worldwide level, radon accounts for around 52 % of global average exposure to natural radiation. The radiological impact of isotope 222 (48 %) is far more significant than isotope 220 (4 %), while isotope 219 is considered negligible. For this reason, references to radon in this part of ISO 11665 refer only to radon-222.

Radon activity concentration can vary by one to multiple orders of magnitude over time and space. Exposure to radon and its decay products varies tremendously from one area to another, as it depends firstly on the amount of radon emitted by the soil and the building materials in each area and, secondly, on the degree of containment and weather conditions in the areas where individuals are exposed. Human exposure to radon is mainly linked to habitat and workplace. Long-term integrated measurement methods are applicable in assessing human exposure to radiation[3]. For reasons of cost and ease of use, long-term measurements (over a period of several months) are only performed with passive sampling[4][5].

The values commonly found in the continental environment are usually between a few becquerels per cubic metre and several thousand becquerels per cubic metre. Activity concentrations of one becquerel per cubic metre or less can be observed in the oceanic environment. Mean annual values of radon activity concentrations inside houses can vary from several tens of becquerels per cubic metre to several thousands of becquerels per cubic metre[2]. Activity concentrations can reach several thousands of becquerels per cubic metre in very confined spaces.

The activity concentration of radon-222 in the atmosphere can be measured by spot, continuous and integrated measurement methods with active or passive air sampling (see ISO 11665-1). This part of ISO 11665 deals with radon-222 integrated measurement techniques with passive sampling.

NOTE The origin of radon-222 and its short-lived decay products in the atmospheric environment and other measurement methods are described generally in ISO 11665-1.

Measurement of radioactivity in the environment — Air: radon-222 —

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

1 Scope

This part of ISO 11665 describes radon-222 integrated measurement techniques with passive sampling. It gives indications for determining the average activity concentration of the radon-222 in the air from measurements based on easy-to-use and low-cost passive sampling, and the conditions of use for the sensors.

This part of ISO 11665 covers samples taken without interruption over periods varying from a few days to one year.

This measurement method is applicable to air samples with radon activity concentrations greater than 5 Bq/m^3.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11665-1, *Measurement of radioactivity in the environment — Air: radon-222 — Part 1: Origins of radon and its short-lived decay products and associated measurement methods*

ISO 11929, *Determination of the characteristic limits (decision threshold, detection limit and limits of the confidence interval) for measurements of ionizing radiation — Fundamentals and application*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

IEC 61577-1, *Radiation protection instrumentation — Radon and radon decay product measuring instruments — Part 1: General principles*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11665-1 apply.

3.2 Symbols

For the purposes of this document, the symbols given in ISO 11665-1 and the following apply.

$\overline{C}$ average activity concentration, in becquerels per cubic metre

$\overline{C}^*$ decision threshold of the average activity concentration, in becquerels per cubic metre

$\overline{C}^\#$ detection limit of the average activity concentration, in becquerels per cubic metre