
Merjenje radioaktivnosti v okolju - Zrak: radon-222 - 7. del: Akumulacijska metoda za ocenjevanje hitrosti površinskega izhajanja (ISO 11665-7:2012)

Measurement of radioactivity in the environment - Air: radon-222 - Part 7: Accumulation method for estimating surface exhalation rate (ISO 11665-7:2012)

Ermittlung der Radioaktivität in der Umwelt - Luft: Radon-222 - Teil 7: Anreicherungsverfahren zur Abschätzung der Oberflächenexhalationsrate (ISO 11665-7:2012)

Mesurage de la radioactivité dans l'environnement - Air: radon 222 - Partie 7: Méthode d'estimation du flux surfacique d'exhalation par la méthode d'accumulation (ISO 11665-7:2012)

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Measurement of radioactivity in the environment - Air: radon-222 - Part 7: Accumulation method for estimating surface exhalation rate (ISO 11665-7:2012)

Mesurage de la radioactivité dans l'environnement -
Air: radon 222 - Partie 7: Méthode d'estimation du flux
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Radon-222 - Teil 7: Anreicherungsverfahren zur
Abschätzung der Oberflächenexhalationsrate (ISO
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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	3

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European foreword

The text of ISO 11665-7:2012 has been prepared by Technical Committee ISO/TC 85 “Nuclear energy, nuclear technologies, and radiological protection” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 11665-7:2015 by Technical Committee CEN/TC 430 “Nuclear energy, nuclear technologies, and radiological protection” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

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

**Part 7:
Accumulation method for estimating
surface exhalation rate**

*Mesurage de la radioactivité dans l'environnement — Air: radon 222 —
Partie 7:
Méthode d'estimation du flux surfacique d'exhalation par la méthode
d'accumulation*

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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Contents	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms, definitions and symbols	1
3.1 Terms and definitions	1
3.2 Symbols	2
4 Principle of the measurement method for estimating surface exhalation rate	2
5 Equipment	4
6 Accumulation of radon in a container	5
6.1 Accumulation characteristics	5
6.2 Accumulation duration	5
7 Sampling	5
7.1 Sampling objective	5
7.2 Sampling characteristics	5
7.3 Sampling duration	6
7.4 Volume of air sampled	6
8 Detection method	6
9 Measurement	6
9.1 Procedure	6
9.2 Influence quantities	7
10 Expression of results	7
10.1 Radon surface exhalation rate	7
10.2 Standard uncertainty	7
10.3 Decision threshold and detection limit	7
10.4 Limits of the confidence interval	8
11 Test report	8
Annex A (informative) Example of a sample results sheet	10
Annex B (informative) Estimation of radon surface exhalation rate using a continuous measurement method	12
Annex C (informative) Estimation of radon surface exhalation rate using a spot measurement method	18
Bibliography	23

ISO 11665-7:2012(E)

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.

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ISO 11665-7 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].

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.

The radon-222 half-life (3,8 days) is long enough for it to migrate from the rock producing it, through the soil, to the air^[3]. The radon atoms in the soil are produced by the disintegration of the radium-226 contained in the mineral grains in the medium. Some of these atoms reach the interstitial spaces between the grains: this is the phenomenon of emanation. Some of the atoms produced by emanation reach the soil's surface by diffusion and convection: this is the phenomenon of exhalation^{[3][4][5]}. These mechanisms are also brought into play in materials (building materials, walls, etc.).

The quantity of radon-222 reaching the open air per unit of time and per unit of surface is called the radon-222 surface exhalation rate and depends on the physical characteristics of the soil and weather conditions. When the ground is covered in snow or a layer of water, or is frozen, this surface exhalation rate can become very weak.

Values of the radon-222 surface exhalation rate observed in France, for example, vary between 1 mBq/m²/s and about 100 mBq/m²/s^{[6][7]}. In uranium-bearing ground, radon-222 surface exhalation rates in the order of 50 000 mBq/m²/s can be observed. By way of comparison, the United Nations Scientific Committee estimates the average surface exhalation rate on the surface of the globe at 20 mBq/m²/s^[8].

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.

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