
Irish Standard
I.S. EN ISO 11665-7:2015

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

**I.S. EN ISO 11665-7:2015**

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## National Foreword

I.S. EN ISO 11665-7:2015 is the adopted Irish version of the European Document EN ISO 11665-7:2015, Measurement of radioactivity in the environment - Air: radon-222 - Part 7: Accumulation method for estimating surface exhalation rate (ISO 11665-7:2012)

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN ISO 11665-7

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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 surfacique d'exhalation par la méthode d'accumulation (ISO 11665-7:2012)

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

This European Standard was approved by CEN on 12 June 2015.

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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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of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

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

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**Endorsement notice**

The text of ISO 11665-7:2012 has been approved by CEN as EN ISO 11665-7:2015 without any modification.

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I.S. EN ISO 11665-7:2015

INTERNATIONAL STANDARD

**ISO 11665-7**

First edition
2012-07-15

# 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*

Reference number
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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.

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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/m$^2$/s and about 100 mBq/m$^2$/s[6][7]. In uranium-bearing ground, radon-222 surface exhalation rates in the order of 50 000 mBq/m$^2$/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/m$^2$/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.

INTERNATIONAL STANDARD ISO 11665-7:2012(E)

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

# Part 7: Accumulation method for estimating surface exhalation rate

## 1 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.

This method is estimative only, as it is difficult to quantify the influence of many parameters in environmental conditions. This part of ISO 11665 is particularly applicable, however, in case of an investigation, a search for sources or a comparative study of exhalation rates at the same site. This part of ISO 11665 does not cover calibration conditions for the rate estimation devices.

The measurement method described is applicable for radon exhalation rates greater than 5 mBq/m$^2$/s.

NOTE The uncertainty relating to the estimation of the result obtained by applying this part of ISO 11665 cannot guarantee that the true flux value is included in the uncertainty domain.

## 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 11665-5, *Measurement of radioactivity in the environment — Air: radon-222 — Part 5: Continuous measurement method of the activity concentration*

ISO 11665-6, *Measurement of radioactivity in the environment — Air: radon-222 — Part 6: Spot measurement method of the activity concentration*

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 and the following apply.

**3.1.1**
**accumulation container**
recipient with known geometric characteristics used to accumulate the radon, with one open face in contact with the surface under investigation