

<b>STN</b>	<b>Kvalita vody Rádium 226 Časť 1: Kvapalinová scintilačná skúšobná metóda (ISO 13165-1: 2013)</b>	<b>STN EN ISO 13165-1</b>  75 7629
------------	--	--

Water quality - Radium-226 - Part 1: Test method using liquid scintillation counting (ISO 13165-1:2013)

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 05/20

Obsahuje: EN ISO 13165-1:2020, ISO 13165-1:2013

**130711**



EUROPEAN STANDARD

**EN ISO 13165-1**

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2020

ICS 13.060.60; 17.240

English Version

**Water quality - Radium-226 - Part 1: Test method using  
liquid scintillation counting (ISO 13165-1:2013)**

Qualité de l'eau - Radium 226 - Partie 1: Méthode  
d'essai par comptage des scintillations en milieu  
liquide (ISO 13165-1:2013)

Wasserbeschaffenheit - Radium-226 - Teil-1: Verfahren  
mit dem Flüssigszintillationszähler (ISO 13165-1:2013)

This European Standard was approved by CEN on 6 October 2019.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

**EN ISO 13165-1:2020 (E)**

<b>Contents</b>	<b>Page</b>
<b>European foreword.....</b>	<b>3</b>

## **European foreword**

The text of ISO 13165-1:2013 has been prepared by Technical Committee ISO/TC 147 "Water quality" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 13165-1:2020 by Technical Committee CEN/TC 230 "Water analysis" the secretariat of which is held by DIN.

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 August 2020, and conflicting national standards shall be withdrawn at the latest by August 2020.

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

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## **Endorsement notice**

The text of ISO 13165-1:2013 has been approved by CEN as EN ISO 13165-1:2020 without any modification.



**INTERNATIONAL  
STANDARD**

**ISO  
13165-1**

First edition  
2013-04-15

---

---

**Water quality — Radium-226 —**

**Part 1:  
Test method using liquid scintillation  
counting**

*Qualité de l'eau — Radium 226 —*

*Partie 1: Méthode d'essai par comptage des scintillations en milieu  
liquide*



Reference number  
ISO 13165-1:2013(E)

© ISO 2013

**ISO 13165-1:2013(E)****COPYRIGHT PROTECTED DOCUMENT**

© ISO 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland



# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Symbols, definitions and units</b> .....	<b>1</b>
<b>4 Principle</b> .....	<b>2</b>
<b>5 Reagents and equipment</b> .....	<b>2</b>
5.1 Reagents.....	2
5.2 Equipment.....	3
<b>6 Sampling</b> .....	<b>3</b>
<b>7 Instrument set-up and calibration</b> .....	<b>4</b>
7.1 Preparation of calibration sources.....	4
7.2 Optimization of counting conditions.....	4
7.3 Detection efficiency.....	4
7.4 Blank sample preparation and measurement.....	5
<b>8 Procedure</b> .....	<b>5</b>
8.1 Direct counting.....	5
8.2 Thermal preconcentration.....	5
8.3 Sample preparation.....	6
8.4 Sample measurement.....	6
<b>9 Quality control</b> .....	<b>6</b>
<b>10 Expression of results</b> .....	<b>6</b>
10.1 Calculation of massic activity.....	6
10.2 Standard uncertainty.....	6
10.3 Decision threshold.....	7
10.4 Detection limit.....	7
10.5 Confidence limits.....	8
10.6 Calculations using the activity concentration.....	8
<b>11 Interference control</b> .....	<b>8</b>
<b>12 Test report</b> .....	<b>9</b>
<b>Annex A (informative) Set-up parameters and validation data</b> .....	<b>10</b>
<b>Bibliography</b> .....	<b>14</b>

## ISO 13165-1:2013(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.

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 13165-1 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 3, *Radioactivity measurements*.

ISO 13165 consists of the following parts, under the general title *Water quality — Radium-226*:

- *Part 1: Test method using liquid scintillation counting*
- *Part 2: Test method using emanometry*

The following part is under preparation:

- *Part 3: Test method using coprecipitation and gamma-spectrometry*

## Introduction

Radioactivity from several naturally occurring and human-made sources is present throughout the environment. Thus, water bodies (surface waters, groundwaters, sea waters) can contain radionuclides of natural and artificial origin (i.e. human-made).

- a) Natural radionuclides, including potassium-40, and those of the thorium and uranium decay series, in particular radium-226, radium-228, uranium-234, uranium-238, lead-210, can be found in water for natural reasons (e.g. desorption from the soil and wash-off by rain water) or release from technological processes involving naturally occurring radioactive materials (e.g. the mining and processing of mineral sands or phosphate fertilizer production and use).
- b) Human-made radionuclides such as transuranium elements (americium, plutonium, neptunium, curium), tritium, carbon-14, strontium-90 and gamma-emitting radionuclides can also be found in natural waters as they can be authorized to be routinely released into the environment in small quantities in the effluent discharged from nuclear fuel cycle facilities and following their use in unsealed form in medicine or industry. They are also found in water due to fallout from past explosions in the atmosphere of nuclear devices and the accidents at Chernobyl and Fukushima.

Drinking water can thus contain radionuclides at activity concentrations which present a risk to human health. In order to assess the quality of drinking-water (including mineral waters and spring waters) with respect to its radionuclide content and to provide guidance on reducing health risks by taking measures to decrease radionuclide activity concentrations, water resources (groundwater, river, lake, sea, etc.) and drinking water are monitored for their radioactivity content as recommended by the World Health Organization (WHO).

An International Standard on a test method of radium-226 activity concentrations in water samples is justified for test laboratories carrying out these measurements, which are sometimes required by national authorities, as laboratories may have to obtain a specific accreditation for radionuclide measurement in drinking water samples.

Radium-226 activity concentration can vary widely according to local geological and climatic characteristics and ranges from 0,001 Bq l<sup>-1</sup> in surface waters up to 50 Bq l<sup>-1</sup> in natural groundwaters; the guidance level for radium-226 in drinking water as recommended by WHO is 1 Bq l<sup>-1</sup> (Reference [Z]).

**NOTE** The guidance level is the activity concentration with an intake of 2 l day<sup>-1</sup> of drinking water for 1 year that results in an effective dose of 0,1 mSv year<sup>-1</sup> for members of the public, an effective dose that represents a very low level of risk that is not expected to give rise to any detectable adverse health effect.

This International Standard is one of a series on determination of the activity concentration of radionuclides in water samples.



# Water quality — Radium-226 —

## Part 1:

### Test method using liquid scintillation counting

**WARNING** — Persons using this part of ISO 13165 should be familiar with normal laboratory practice. This part of ISO 13165 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

**IMPORTANT** — It is absolutely essential that tests conducted in accordance with this part of ISO 13165 be carried out by suitably qualified staff.

## 1 Scope

This part of ISO 13165 specifies the determination of radium-226 ( $^{226}\text{Ra}$ ) activity concentration in non-saline water samples by extraction of its daughter radon-222 ( $^{222}\text{Rn}$ ) and its measurement using liquid scintillation counting.

Radium-226 activity concentrations which can be measured by this test method utilizing currently available liquid scintillation counters goes down to 50 mBq l<sup>-1</sup>. This method is not applicable to the measurement of other radium isotopes.

## 2 Normative references

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

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes and sampling techniques*

ISO 5667-3, *Water quality — Sampling — Part 3: Preservation and handling of water samples*

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

ISO 80000-10, *Quantities and units — Part 10: Atomic and nuclear physics*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

**koniec náhl'adu – text ďalej pokračuje v platenej verzii STN**