BS ISO 13164-1:2013
Incorporating corrigendum January 2014

BSI Standards Publication

Water quality — Radon-222

Part 1: General principles

National foreword

This British Standard is the UK implementation of ISO 13164-1:2013.

The UK participation in its preparation was entrusted by Technical Committee EH/3, Water quality, to Subcommittee EH/3/8, Radioactivity measurements.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2014

ISBN 978 0 580 85225 1

ICS 13.060.60; 13.280; 17.240

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2013.

Amendments/corrigenda issued since publication

Date	Text affected
31 January 2014	Implementation of ISO corrected text 15 November 2013: Table 2 and clauses B.2 and B.3 corrected

INTERNATIONAL STANDARD

ISO 13164-1

First edition
2013-09-01

Corrected version
2013-11-15

Water quality — Radon-222 —

Part 1: General principles

Qualité de l'eau — Radon 222 —

Partie 1: Principes généraux

Reference number
ISO 13164-1:2013(E)

COPYRIGHT PROTECTED DOCUMENT

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
Web www.iso.org

Published in Switzerland

Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2, www.iso.org/directives.

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received, www.iso.org/patents.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 147, *Water quality*, Subcommittee SC 3, *Radioactivity measurements*.

ISO 13164 consists of the following parts, under the general title *Water quality — Radon-222*:

— *Part 1: General principles*

— *Part 2: Test method using gamma-ray spectrometry*

— *Part 3: Test method using emanometry*

The following part is under preparation:

— *Part 4: Test method using two-phase liquid scintillation counting*

This corrected version of ISO 13164-1:2013 incorporates the following corrections:

— Table 2: The check marks which printed out incorrectly in the last two columns have been changed to X's. The X's from the cells "Gamma spectrometry – On-site" and "Liquid scintillation – On-site" have been removed.

— Annex B: The examples of data record forms for B.2 and B.3 were inversed. They are now in the right places.

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 human-made origin.

— 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 releases from technological processes involving naturally occurring radioactive materials (e.g. the mining and processing of mineral sands or phosphate fertilizer production and use).

— 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 used in unsealed form in medicine or industry. They are also found in water due to the past fallout of the explosion in the atmosphere of nuclear devices and the accidents at Chernobyl and Fukushima.

Drinking-water can thus contain radionuclides at activity concentration which could 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 monitor for their radioactivity content as recommended by the World Health Organization (WHO).

Standard test methods for radon-222 activity concentrations in water samples are needed by test laboratories carrying out such measurements in fulfillment of national authority requirements. Laboratories may have to obtain a specific accreditation for radionuclide measurement in drinking water samples.

The radon activity concentration in surface water is very low, usually below 1 Bq l^{-1}. In groundwater, the activity concentration varies from 1 Bq l^{-1} up to 50 Bq l^{-1} in sedimentary rock aquifers, from 10 Bq l^{-1} up to 300 Bq l^{-1} in wells, and from 100 Bq l^{-1} up to 1 000 Bq l^{-1} in crystalline rocks. The highest activity concentrations are normally measured in rocks with high concentration of uranium (Reference [30]).

High variations in the activity concentrations of radon in aquifers have been observed. Even in a region with relatively uniform rock types, some well water may exhibit radon activity concentration greatly higher than the average value for the same region. Significant seasonal variations have also been recorded (see Annex A).

Water may dissolve chemical substances as it passes from the soil surface to an aquifer or spring waters. The water may pass through or remain for some time in rock, some formations of which may contain a high concentration of natural radionuclides. Under favourable geochemical conditions, the water may selectively dissolve some of these natural radionuclides.

Guidance on radon in drinking-water supplies provided by WHO in 2008 suggests that controls should be implemented if the radon concentration of drinking-water for public water supplies exceeds 100 Bq l^{-1}. It also recommended that any new, especially public, drinking-water supply using groundwater should be tested prior to being used for general consumption and that if the radon concentration exceeds 100 Bq l^{-1}, treatment of the water source should be undertaken to reduce the radon levels to well below that level (Reference [41]).

This International Standard is one of a series dealing with the measurement of the activity concentration of radionuclides in water samples.

INTERNATIONAL STANDARD ISO 13164-1:2013(E)

Water quality — Radon-222 —

Part 1: General principles

WARNING — Persons using this document should be familiar with normal laboratory practice. This document 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 document be carried out by suitably qualified staff.

1 Scope

This part of ISO 13164 gives general guidelines for sampling, packaging, and transporting of all kinds of water samples, for the measurement of the activity concentration of radon-222.

The test methods fall into two categories:

a) direct measurement of the water sample without any transfer of phase (see ISO 13164-2);

b) indirect measurement involving the transfer of the radon-222 from the aqueous phase to another phase (see ISO 13164-3).

The test methods can be applied either in the laboratory or on site.

The laboratory is responsible for ensuring the suitability of the test method for the water samples tested.

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 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 10703, *Water quality — Determination of the activity concentration of radionuclides — Method by high resolution gamma-ray spectrometry*

ISO 13164-2, *Water quality — Radon-222 — Part 2: Test method using gamma-ray spectrometry*

ISO 13164-3, *Water quality — Radon-222 — Part 3: Test method using emanometry*

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*