



BSI Standards Publication

Water quality — Radium-226

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

National foreword

This British Standard is the UK implementation of EN ISO 13165-3:2024. It is identical to ISO 13165-3:2024. It supersedes BS EN ISO 13165-3:2020, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/3/8, Radioactivity measurements methods.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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mittels Kopräzipitation und Gamma-Ray-
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European foreword

This document (EN ISO 13165-3:2024) has been prepared by Technical Committee ISO/TC 147 "Water quality" in collaboration with 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of an identical text or by endorsement, at the latest by June 2025, and conflicting national standards shall be withdrawn at the latest by June 2025.

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.

This document supersedes EN ISO 13165-3:2020.

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Endorsement notice

The text of ISO 13165-3:2024 has been approved by CEN as EN ISO 13165-3:2024 without any modification.

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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.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 3, *Radioactivity measurements*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 230, *Water analysis*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 13165-3:2016), which has been technically revised.

The main changes are as follows:

- the introduction has been completely revised;
- the principal of measurement in [Clause 5](#) has been expanded;
- the instrument verification subclause (formerly [9.3](#)) has been deleted;
- formulae for the coverage intervals according to ISO 11929 series have been updated;
- requirements of the test report have been updated.

A list of all parts in the ISO 13165 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Radionuclides are present throughout the environment; thus, water bodies (e.g. surface waters, ground waters, sea waters) contain radionuclides, which can be of either natural or anthropogenic origin.

- Naturally-occurring radionuclides, including ^3H , ^{14}C , ^{40}K , and those originating from the thorium and uranium decay series (see [Annex A](#)), in particular ^{210}Pb , ^{210}Po , ^{222}Rn , ^{226}Ra , ^{228}Ra , ^{227}Ac , ^{231}Pa , ^{234}U , and ^{238}U , can be found in water bodies due to either natural processes (e.g. desorption from the soil, runoff by rain water) or released from technological processes involving naturally occurring radioactive materials (e.g. mining, mineral processing, oil, gas and coal production, water treatment, and the production and use of phosphate fertilisers).
- Anthropogenic radionuclides, such as ^{55}Fe , ^{59}Ni , ^{63}Ni , ^{90}Sr , ^{99}Tc , transuranic elements (e.g. Np, Pu, Am, Cm) and some gamma emitting radionuclides, such as ^{60}Co , ^{137}Cs , can also be found in natural waters. Small quantities of anthropogenic radionuclides can be discharged from nuclear facilities to the environment as a result of authorized routine releases. The radionuclides present in liquid effluents are usually controlled before being discharged into the environment^[1] and water bodies. Anthropogenic radionuclides used in medical and industrial applications can be released to the environment after use. Anthropogenic radionuclides are also found in waters due to contamination from fallout resulting from above-ground nuclear detonations and accidents such as those that have occurred at the Chornobyl and Fukushima nuclear facilities.

Radionuclide activity concentrations in water bodies can vary according to local geological characteristics and climatic conditions and can be locally and temporally enhanced by releases from nuclear facilities during planned, existing and emergency exposure situations^{[2],[3]}. Some drinking water sources can thus contain radionuclides at activity concentrations that can present a human health risk. The World Health Organization (WHO) recommends to routinely monitor radioactivity in drinking waters^[4] and to take proper actions when needed to minimize the health risk.

National regulations usually specify the activity concentration limits that are authorized in drinking waters, water bodies and liquid effluents to be discharged to the environment. These limits can vary for planned, existing and emergency exposure situations. As an example, during either a planned or existing situation, the WHO guidance level for ^{226}Ra in drinking water is $1 \text{ Bq}\cdot\text{l}^{-1}$, see NOTE. Compliance with these limits is assessed by measuring radioactivity in water samples and by comparing the results obtained, with their associated uncertainties, as specified by ISO/IEC Guide 98-3^[5] and ISO 5667-20^[6].

NOTE The guidance level calculated in Reference ^[4] is the activity concentration that, with an intake of $2 \text{ l}\cdot\text{d}^{-1}$ of drinking water for one year, results in an effective dose of $0,1 \text{ mSv}\cdot\text{a}^{-1}$ to members of the public. This is an effective dose that represents a very low level of risk to human health and which is not expected to give rise to any detectable adverse health effects^[4].

This document contains method(s) to support laboratories, which need to determine ^{226}Ra in water samples.

The method described in this document can be used for various types of waters (see [Clause 1](#)). Minor modifications to, for example, the sample volume and the counting time, can be made if needed to ensure that the characteristic limit, decision threshold, detection limit and uncertainties are below the required limits. This can be done for several reasons such as emergency situations, lower national guidance limits and operational requirements.

This document deals with the measurement of the activity concentration of radionuclides in water samples.

