INTERNATIONAL STANDARD

ISO 9696

Third edition
2017-10

Water quality — Gross alpha activity — Test method using thick source

Qualité de l'eau — Activité alpha globale — Méthode d'essai par source concentrée

Reference number
ISO 9696:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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 (see 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 (see 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.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 3, *Radioactivity measurements*.

This third edition cancels and replaces the second edition (ISO 9696:2007), which has been technically revised.

Introduction

Radioactivity from several naturally occurring and anthropogenic sources is present throughout the environment. Thus, water bodies (e.g. surface waters, ground waters, sea waters) can contain radionuclides of natural, human-made or of both origins:

— natural radionuclides, including ^{40}K, ^{3}H, ^{14}C, and those originating from the thorium and uranium decay series, in particular ^{226}Ra, ^{228}Ra, ^{234}U, ^{238}U, ^{210}Po and ^{210}Pb, can be found in water for natural reasons (e.g. desorption from the soil and runoff by rain water) or can be released from technological processes involving naturally occurring radioactive materials (e.g. the mining and processing of mineral sands or phosphate fertilizers production and use);

— anthropogenic radionuclides, such as the transuranium elements (e.g. americium, plutonium, neptunium and curium), ^{3}H, ^{14}C, ^{90}Sr, and some gamma-emitting radionuclides can also be found in natural waters. Small quantities of these radionuclides may be discharged from nuclear fuel cycle facilities into the environment as the result of authorized routine releases. Some of these radionuclides used for medical and industrial applications may also be released into the environment after use. Anthropogenic radionuclides are also found in waters as the result of past fallout contamination resulting from the above ground detonation of nuclear devices and accidents such as those that occurred in Chernobyl and Fukushima.

Radionuclide activity concentration in water bodies can vary according to local geological characteristics and climatic conditions and can be locally and temporally enhanced by releases from nuclear installation during planned, existing and emergency exposure situations[1]. Drinking water may thus contain radionuclides at activity concentrations which could present a risk to human health.

The radionuclides present in liquid effluents are usually controlled before being discharged into the environment[2] and water bodies. Drinking water may be monitored for their radioactivity as recommended by the World Health Organization (WHO)[3]. Such control and monitoring can enable to take proper actions to ensure that there is no adverse health effects to the public. Following these international recommendations, radionuclide authorized concentration limits for liquid effluent discharged to the environment and radionuclide guidance levels for water bodies and drinking water are usually specified by national regulations for planned, existing and emergency exposure situations. Compliance with these limits can be assessed using measurement results with their associated uncertainties as requested by ISO/IEC Guide 98-3 and ISO 5667-20.

Depending on the exposure situation, the limits and guidance levels that would result in an action to reduce health risk differ. As an example, during planned or existing situation, the WHO guidance for screening levels in drinking water is 0,5 Bq·l^{-1} for gross alpha activity and 1 Bq·l^{-1} for gross beta activity.

NOTE The guidance level is the activity concentration with an intake of 2 l·d^{-1} of drinking water for 1 year that results in an effective dose of 0,1 mSv·a^{-1} 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[3].

Thus, the test method may need to be adjusted depending if it is applied for either a planned-existing or an emergency situation since during emergency situations, a large number of samples needs to be rapidly characterized. The test methods could be adapted so that its performance in term of characteristic limits, decision threshold and detection limit, and the uncertainties ensure that the gross activity concentration test results permit the verification that they are below the guidance levels required by national authority for either planned-existing situations or an emergency situation[5][6][7].

Usually, the test methods can be adjusted to measure the gross activity concentration of the radionuclide(s) in either wastewaters before storage or in liquid effluents before being discharged to the environment. The test results will enable the plant/installation operator to comply with national regulations in verifying that before their discharge, wastewaters/liquid effluent radioactive activity concentrations are lower than the authorized limits.

The test method(s) described in this document may be used during planned, existing and emergency exposure situations, as well as for wastewaters and liquid effluents with specific modifications that could increase the overall uncertainty, detection limit and threshold.

The test method(s) may be used for water samples after proper sampling, sample handling and test sample preparation (see the ad hoc part of ISO 5667).

An international standard on a test method of gross alpha and gross beta activity concentrations in water samples is justified for test laboratories carrying out these measurements and may be required by national authorities, as laboratories may have to obtain a specific accreditation for radionuclide measurement of drinking water samples.

This document is one of a set of International Standards on test methods dealing with the measurement of the activity concentration of radionuclides in water samples.

Water quality — Gross alpha activity — Test method using thick source

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 trained staff.

1 Scope

This document specifies a method for the determination of gross alpha activity in non-saline waters for alpha-emitting radionuclides which are not volatile up to 350 °C.

The method is applicable to raw and potable waters.

The range of application depends on the amount of total soluble salts in the water and on the performance characteristics (background count rate and counting efficiency) of the counter.

It is the laboratory's responsibility to ensure the suitability of this method for the water samples tested.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3696:1987, *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 5667-14, *Water quality — Sampling — Part 14: Guidance on quality assurance and quality control of environmental water sampling and handling*

ISO 11929, *Determination of the characteristic limits (decision threshold, detection limit and limits of the confidence interval) for measurements of ionizing radiation — Fundamentals and application*

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

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

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

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11929, ISO 80000-10, ISO/IEC Guide 98-3 and ISO/IEC Guide 99 apply.