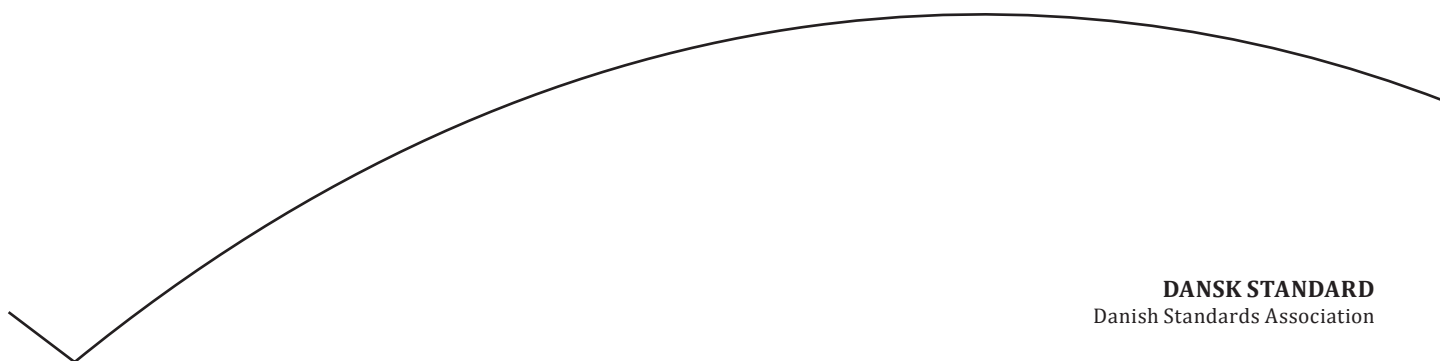


This is a preview of "DS/EN ISO 11704:2018". [Click here to purchase the full version from the ANSI store.](#)

Vandundersøgelse – Total alfa- og betaaktivitet – Prøvningsmetode: væskescintillationstælling

Water quality – Gross alpha and gross beta activity – Test
method using liquid scintillation counting (ISO 11704:2018)



DANSK STANDARD
Danish Standards Association

Göteborg Plads 1
DK-2150 Nordhavn

Tel: +45 39 96 61 01

Tel: +45 39 96 61 01

dansk.standard@ds.dk

www.ds.dk

This is a preview of "DS/EN ISO 11704:2018". Click here to purchase the full version from the ANSI store.

DS projekt: M317853
ICS: 13.060.60; 17.240

Første del af denne publikations betegnelse er:

DS/EN ISO, hvilket betyder, at det er en international standard, der har status både som europæisk og dansk standard.

Denne publikations overensstemmelse er:

IDT med: ISO 11704:2018

IDT med: EN ISO 11704:2018

DS-publikationen er på engelsk.

Denne publikation erstatter: [DS/EN ISO 11704:2015](#)

DS-publikationstyper

Dansk Standard udgiver forskellige publikationstyper.

Typen på denne publikation fremgår af forsiden.

Der kan være tale om:

Dansk standard

- standard, der er udarbejdet på nationalt niveau, eller som er baseret på et andet lands nationale standard, eller
- standard, der er udarbejdet på internationalt og/eller europæisk niveau, og som har fået status som dansk standard

DS-information

- publikation, der er udarbejdet på nationalt niveau, og som ikke har opnået status som standard, eller
- publikation, der er udarbejdet på internationalt og/eller europæisk niveau, og som ikke har fået status som standard, fx en teknisk rapport, eller
- europæisk præstandard

DS-håndbog

- samling af standarder, eventuelt suppleret med informativt materiale

DS-hæfte

- publikation med informativt materiale

Til disse publikationstyper kan endvidere udgives

- tillæg og rettelsesblade

DS-publikationsform

Publikationstyperne udgives i forskellig form som henholdsvis

- fuldtekstpublikation (publikationen er trykt i sin helhed)
- godkendelsesblad (publikationen leveres i kopi med et trykt DS-omslag)
- elektronisk (publikationen leveres på et elektronisk medie)

DS-betegnelse

Alle DS-publikationers betegnelse begynder med DS efterfulgt af et eller flere præfikser og et nr., fx **DS 383**, **DS/EN 5414** osv. Hvis der efter nr. er angivet et **A** eller **Cor**, betyder det, enten at det er et **tillæg** eller et **rettelsesblad** til hovedstandard, eller at det er indført i hovedstandard.

DS-betegnelse angives på forsiden.

Overensstemmelse med anden publikation:

Overensstemmelse kan enten være IDT, EQV, NEQ eller MOD

- **IDT:** Når publikationen er identisk med en given publikation.
- **EQV:** Når publikationen teknisk er i overensstemmelse med en given publikation, men præsentationen er ændret.
- **NEQ:** Når publikationen teknisk eller præsentationsmæssigt ikke er i overensstemmelse med en given standard, men udarbejdet på baggrund af denne.
- **MOD:** Når publikationen er modificeret i forhold til en given publikation.

This is a preview of "DS/EN ISO 11704:2018". Click here to purchase the full version from the ANSI store.

EUROPÄISCHE NORM

December 2018

ICS 13.060.60; 17.240

Supersedes EN ISO 11704:2015

English Version

Water quality - Gross alpha and gross beta activity - Test method using liquid scintillation counting (ISO 11704:2018)

Qualité de l'eau - Activités alpha globale et bêta
globale - Méthode d'essai par comptage des
scintillations en milieu liquide (ISO 11704:2018)

Wasserbeschaffenheit - Gesamt-Alpha- und
Gesamt-Beta-Aktivität - Verfahren mit dem
Flüssigszintillationszähler (ISO 11704:2018)

This European Standard was approved by CEN on 1 November 2018.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, 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: Avenue Marnix 17, B-1000 Brussels

This is a preview of "DS/EN ISO 11704:2018". Click [here](#) to purchase the full version from the ANSI store.

Contents

Page

European foreword	3
-------------------------	---

This is a preview of "DS/EN ISO 11704:2018". Click [here](#) to purchase the full version from the ANSI store.

European foreword

This document ([EN ISO 11704:2018](#)) 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 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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 11704:2015](#).

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of [ISO 11704:2018](#) has been approved by CEN as [EN ISO 11704:2018](#) without any modification.

This is a preview of "DS/EN ISO 11704:2018". [Click here to purchase the full version from the ANSI store.](#)

Second edition
2018-11-12

Water quality — Gross alpha and gross beta activity — Test method using liquid scintillation counting

Qualité de l'eau — Activités alpha globale et bêta globale — Méthode d'essai par comptage des scintillations en milieu liquide



Reference number
ISO 11704:2018(E)

© ISO 2018

This is a preview of "DS/EN ISO 11704:2018". Click [here](#) to purchase the full version from the ANSI store.



COPYRIGHT PROTECTED DOCUMENT

© ISO 2018, Published in Switzerland

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
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

This is a preview of "DS/EN ISO 11704:2018". Click here to purchase the full version from the ANSI store.

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms, definitions, symbols and abbreviated terms	2
3.1 Terms and definitions.....	2
3.2 Symbols and abbreviated terms.....	2
4 Principle	3
5 Reagents and equipment	3
6 Sampling	5
7 Procedure	5
7.1 Direct counting.....	5
7.2 Thermal preconcentration.....	5
7.3 Sample preparation	6
7.4 Liquid scintillation measurement.....	6
7.4.1 Preparation of alpha and beta calibration sources	6
7.4.2 Optimization of counting conditions.....	6
7.4.3 Blank sample preparation and measurement.....	7
7.4.4 Alpha and beta efficiencies	7
7.4.5 Sample measurement.....	8
8 Expression of results	8
8.1 Calculation of activity per mass.....	8
8.2 Standard uncertainty.....	9
8.3 Decision threshold.....	10
8.4 Detection limit.....	10
8.5 Confidence limits.....	10
8.6 Quality control.....	11
9 Interference control	11
9.1 Contamination.....	11
9.2 Ingrowth of radon	11
9.3 Loss of polonium.....	11
10 Test report	11
Annex A (informative) Set-up parameters and validation data	13
Annex B (informative) Method performances under different conditions	17
Bibliography	18

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 of 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 www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition ([ISO 11704:2010](http://www.iso.org/iso/11704:2010)), which has been technically revised. The main changes compared to the previous edition are as follows:

- [5.5.1](#) has been simplified;
- the application field of this document has been extended to emergency situations;
- slightly different counting conditions have been suggested;
- [Annexes A](#) and [B](#) have been added.

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.

This is a preview of "DS/EN ISO 11704:2018". Click [here](#) to purchase the full version from the ANSI store.

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 both origins:

- natural radionuclides, including ^{40}K , ^3H , ^{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 washoff 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);
- human-made radionuclides, such as transuranium elements (americium, plutonium, neptunium, curium), ^3H , ^{14}C , ^{90}Sr and gamma emitting radionuclides can also be found in natural waters. Small quantities of these radionuclides are discharged from nuclear fuel cycle facilities into the environment as a result of authorized routine releases. Some of these radionuclides used for medical and industrial applications are also released into the environment after use. Anthropogenic radionuclides are also found in waters as a result of past fallout contaminations resulting from the explosion in the atmosphere 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 waters are monitored for their radioactivity as recommended by the World Health Organization (WHO)^[3] so that proper actions can be taken to ensure that there is no adverse health effect to the public. Following these international recommendations, national regulations usually specify radionuclide authorized concentration limits for liquid effluent discharged to the environment and radionuclide guidance levels for water bodies and drinking waters for planned, existing and emergency exposure situations. Compliance with these limits can be assessed using measurement results with their associated uncertainties as specified by [ISO/IEC Guide 98-3](#)^[4] and [ISO 5667-20](#)^[5].

Depending on the exposure situation, there are different limits and guidance levels that would result in an action to reduce health risk. As an example, during a planned or existing situation, the WHO guidelines for guidance level in drinking water is 0,5 Bq/l for gross alpha activity and 1 Bq/l for gross beta activity.

NOTE — The guidance level is the activity concentration with an intake of 2 l/d of drinking water for one year that results in an effective dose of 0,1 mSv/a for members of the public. This is an effective dose that represents a very low level of risk and which is not expected to give rise to any detectable adverse health effects^[3].

Thus, the test method can be adapted so that the characteristic limits, decision threshold, detection limit and uncertainties ensure that the radionuclide activity concentrations test results can be verified to be below the guidance levels required by a national authority for either planned/existing situations or for an emergency situation^[6]^[7]^[8].

Usually, the test methods can be adjusted to measure the activity concentration of the radionuclide(s) in either waste waters before storage or in liquid effluents before being discharged to the environment. The test results will enable the plant/installation operator to verify that, before their discharge, waste waters/liquid effluent radioactive activity concentrations do not exceed authorized limits.

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

This is a preview of "DS/EN ISO 11704:2018". [Click here to purchase the full version from the ANSI store.](#)

The test method(s) may be used for water samples after proper sampling, sample handling and test sample preparation (see the relevant part of the [ISO 5667 series](#)).

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, required sometimes by national authorities, as laboratories may have to obtain a specific accreditation for radionuclide measurement in 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.

This is a preview of "DS/EN ISO 11704:2018". Click [here](#) to purchase the full version from the ANSI store.

Water quality — Gross alpha and gross beta activity — Test method using liquid scintillation counting

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.

IMPORTANT — It is absolutely essential that tests conducted according to this document be carried out by suitably trained staff.

1 Scope

This document specifies a method for the determination of gross alpha and gross beta activity concentration for alpha- and beta-emitting radionuclides using liquid scintillation counting (LSC).

The method is applicable to all types of waters with a dry residue of less than 5 g/l and when no correction for colour quenching is necessary.

Gross alpha and gross beta activity measurement is not intended to give an absolute determination of the activity concentration of all alpha- and beta-emitting radionuclides in a test sample, but is a screening analysis to ensure particular reference levels of specific alpha and beta emitters have not been exceeded. This type of determination is also known as gross alpha and beta index. Gross alpha and beta analysis is not expected to be as accurate nor as precise as specific radionuclide analysis after radiochemical separations.

The method covers non-volatile radionuclides below 80 °C, since some gaseous or volatile radionuclides (e.g. radon and radioiodine) can be lost during the source preparation.

The method is applicable to test samples of drinking water, rain water, surface and ground water as well as cooling water, industrial water, domestic and industrial waste water after proper sampling and test sample preparation (filtration when necessary and taking into account the amount of dissolved material in the water).

The method described in this document is applicable in the event of an emergency situation, because the results can be obtained in less than 4 h by directly measuring water test samples without any treatment.

It is the laboratory's responsibility to ensure the suitability of this test 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](#), *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*