EESTI STANDARD EVS-EN ISO 9698:2015

Water quality - Determination of tritium activity concentration - Liquid scintillation counting method (ISO 9698:2010)

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA	NATIONAL FOREWORD
See Eesti standard EVS-EN ISO 9698:2015 sisaldab Euroopa standardi EN ISO 9698:2015 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 9698:2015 consists of the English text of the European standard EN ISO 9698:2015.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 22.07.2015.	Date of Availability of the European standard is 22.07.2015.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.060.60, 13.080

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 9698

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English Version

Water quality - Determination of tritium activity concentration - Liquid scintillation counting method (ISO 9698:2010)

Qualité de l'eau - Détermination de l'activité volumique du tritium - Méthode par comptage des scintillations en milieu liquide (ISO 9698:2010)

Wasserbeschaffenheit - Bestimmung der Aktivitätskonzentration von Tritium - Verfahren mit dem Flüssigszintillationszähler (ISO 9698:2010)

This European Standard was approved by CEN on 16 July 2015.

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.

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

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European foreword

The text of ISO 9698:2010 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 9698:2015 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 January 2016, and conflicting national standards shall be withdrawn at the latest by January 2016.

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

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Endorsement notice

The text of ISO 9698:2010 has been approved by CEN as EN ISO 9698:2015 without any modification.

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Introduction

The tritium present in the environment is of natural origin and man made. As a result of atmospheric nuclear weapon testing, emissions from nuclear engineering installations, and the application and processing of isotopes, relatively large amounts of tritium have been released to the environment. Despite the low dose factor associated to tritium, monitoring of tritium activity concentrations in the environment is necessary in order to follow its circulation in the hydrosphere and biosphere.

Water quality — Determination of tritium activity concentration — Liquid scintillation counting method

WARNING — This International Standard 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 according to this International Standard be carried out by suitably trained staff.

1 Scope

This International Standard specifies the conditions for the determination of tritium activity concentration in samples of environmental water or of tritiated water ($[^3H]H_2O$) using liquid scintillation counting.

The choice of the analytical procedure, either with or without distillation of the water sample prior to determination, depends on the aim of the measurement and the sample characteristics (see References [1], [2], [3]).

Direct measurement of a raw water sample using liquid scintillation counting has to consider the potential presence of other beta emitter radionuclides. To avoid interference with these radionuclides when they are detected, the quantification of tritium will be performed following the sample treatment by distillation (see References [4], [5], [6], [7]). Three distillation procedures are described in Annexes B, D and E.

The method is not applicable to the analysis of organically bound tritium; its determination requires additional chemical processing (such as chemical oxidation or combustion).

With suitable technical conditions, the detection limit may be as low as 1 Bq l^{-1}. Tritium activity concentrations below 10^6 Bq l^{-1} can be determined without any sample dilution. A prior enrichment step can significantly lower the limit of detection (see References [8], [9]).

2 Normative references

The following referenced documents are indispensable for the application 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 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: Guidance on the preservation and handling of water samples*

ISO 5667-14, *Water quality — Sampling — Part 14: Guidance on quality assurance of environmental water sampling and handling*

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

ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Symbols, definitions and units

For the purposes of this document, the definitions, symbols and units defined in ISO 80000-10, ISO/IEC Guide 98-3 and ISO/IEC Guide 99, as well as the following symbols, apply.

β_{max}	Maximum energy for the beta emission, in kilo-electronvolts
V	Volume of test sample, in litres
m	Mass of test sample, in kilograms
ρ	Mass density of the sample, in grams per litre
c_A	Activity concentration, in becquerels per litre
a	Activity per unit of mass, in becquerels per kilogram
A	Activity of the calibration source, in becquerels
t_0	Background counting time, in seconds
t_{g}	Sample counting time, in seconds
t_{s}	Calibration counting time, in seconds
n	Number of repetitions
r_{0i}	Background count rate in the repetition i, per second
r_0	Mean background count rate for i repetitions, per second
$r_{\mathrm{g}i}$	Sample count rate in the repetition i, per second
r_{g}	Mean sample count rate for i repetitions, per second
r_{s}	Calibration count rate, per second
ε	Detection efficiency
ε_{q}	Efficiency measured for each of the working standards to elaborate the quench curve
f_{q}	Quench factor
$u(c_A)$	Standard uncertainty associated with the measurement result, in becquerels per litre
U	Expanded uncertainty, calculated by $U = k \cdot u(c_A)$ with $k = 1, 2, \ldots$, in becquerels per litre
c_A^{*}	Decision threshold, in becquerels per litre
$c_A^{\#}$	Detection limit, in becquerels per litre
$c_A^{\triangleleft}, c_A^{\triangleright}$	Lower and upper limits of the confidence interval, in becquerels per litre

