
Kakovost vode - Tehnecij Tc-99 - 2. del: Preskusna metoda z masno spektrometrijo z induktivno sklopljeno plazmo (ICP-MS) (ISO/DIS 22125-2:2026)

Water quality - Technetium-99 - Part 2: Test method using inductively coupled plasma mass spectrometry (ICP-MS) (ISO/DIS 22125-2:2026)

Wasserbeschaffenheit - Technetium 99 - Teil 2: Verfahren mittels Massenspektrometrie und induktiv gekoppeltem Plasma (ISO/DIS 22125-2:2026)

Qualité de l'eau - Technétium-99 - Partie 2: Méthode d'essai par spectrométrie de masse avec plasma à couplage inductif (ICP-MS) (ISO/DIS 22125-2:2026)

Ta slovenski standard je istoveten z: prEN ISO 22125-2

ICS:

13.060.50	Preiskava vode na kemične snovi	Examination of water for chemical substances
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DRAFT International Standard

ISO/DIS 22125-2

Water quality — Technetium-99 — Part 2: Test method using inductively coupled plasma mass spectrometry (ICP-MS)

Qualité de l'eau — Technétium-99 —

Partie 2: Méthode d'essai par spectrométrie de masse couplée à un plasma induit (ICP-MS)

ICS: 13.060.60; 17.240

ISO/TC 147/SC 3

Secretariat: **AFNOR**

Voting begins on:
2026-07-02

Voting terminates on:
2026-09-24

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 22125-2:2026(en)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

ISO/DIS 22125-2:2026(en)

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Foreword

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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 22125-2:2019), which has been technically revised.

The main changes are as follows:

- The format of the standard has been modified to align with the most recent ones;
- The most recent version of the introduction, sampling, quality assurance and quality control, and the test report sections have been added;
- The formulae and their symbols have been reviewed.

A list of all the parts in the ISO 22125 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.

ISO/DIS 22125-2:2026(en)

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, in particular ^{210}Pb , ^{210}Po , ^{222}Rn , ^{226}Ra , ^{228}Ra , ^{227}Ac , ^{232}Th , ^{231}Pa , ^{234}U and ^{238}U , can be found in water bodies due to either natural processes (e.g. desorption from the soil and 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 and ^{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 to the environment^[4] and water bodies. Anthropogenic radionuclides used for 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 ^{99}Tc in drinking water is $100 \text{ Bq}\cdot\text{l}^{-1}$ ^[4], see NOTES 1 and 2. Compliance with these limits can be assessed using measurement results with their associated uncertainties, as specified by ISO/IEC Guide 98-3:2008^[5] and ISO 5667-20:2008^[6].

NOTE 1 If the value is not specified in Annex 6 of Reference ^[4], the value has been calculated using the formula provided in Reference ^[4] and the dose coefficient data from References ^[7] and ^[8].

NOTE 2 The guidance level calculated in Reference ^[4] is the activity concentration that results in an effective dose of $0,1 \text{ mSv}\cdot\text{a}^{-1}$ to members of the public for an intake of $2 \text{ l}\cdot\text{d}^{-1}$ of drinking water for one year. 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 ^{99}Tc in water samples. The method described in this document can be used for various types of waters (see [Clause 1](#)). For ICP-MS methods, minor modifications to, for example, the sample pre-concentration volume and the interference separation can be made if needed to ensure that limit of detection, limit of quantification 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.

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Water quality — Technetium-99 —

Part 2:

Test method using inductively coupled plasma mass spectrometry (ICP-MS)

1 Scope

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.

Warning — It is absolutely essential that tests conducted in accordance with this document be carried out by suitably qualified staff.

This document specifies methods to determine ^{99}Tc by inductively coupled plasma mass spectrometry (ICP-MS) in supply water, drinking water, rainwater, surface and ground water, marine water, as well as cooling water, industrial water, domestic, and industrial wastewater after proper sampling, handling, and test sample preparation.

The detection limit depends on the sample volume, the instrument used, the background count rate, the detection efficiency, the counting time, and the chemical yield. The detection limit of the methods described in this document, using currently available ICP-MS instrumentation, is approximately $0,2 \text{ ng}\cdot\text{l}^{-1}$ to $0,5 \text{ ng}\cdot\text{l}^{-1}$ ($0,1 \text{ Bq}\cdot\text{l}^{-1}$ to $0,3 \text{ Bq}\cdot\text{l}^{-1}$), which is much lower than the WHO criteria for safe consumption of drinking water ($100 \text{ Bq}\cdot\text{l}^{-1}$)^[4]. The methods presented in this document are not intended for the determination of ultra-trace amount of ^{99}Tc .

The methods described in this document are applicable in the event of an emergency situation, but not if $^{99\text{m}}\text{Tc}$ is present at quantities that could cause interference.

Filtration of the test sample is necessary for the methods described in this document if suspended solids are present. The analysis of ^{99}Tc adsorbed to suspended matter is not covered by this method. The analysis of the insoluble fraction requires a mineralization step that is not covered by this document. In this case, the measurement is made on the different phases obtained.

It is the user's responsibility to ensure the validity 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 17294-1:2024, *Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) — Part 1: General requirements*

3 Terms, definitions and symbols

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