SLOVENSKI STANDARD
SIST EN ISO 20045:2024

01-september-2024

Merjenje radioaktivnosti v okolju - Zrak: tritij - Preskusna metoda z vzorčenjem z mehurčki (ISO 20045:2023, vključno s popravljeno različico 2023-09)

Measurement of the radioactivity in the environment - Air: tritium - Test method using bubbler sampling (ISO 20045:2023, vključno s popravljeno različico 2023-09)

Bestimmung der Radioaktivität in der Umwelt - Luft: Tritium - Messverfahren mit Sammlung mittels Gaswaschflaschen (ISO 20045:2023, vključno s popravljeno različico 2023-09)

Mesurage de la radioactivité dans l'environnement - Air : tritium - Méthode d'essai à l'aide d'un prélèvement par barbotage (ISO 20045:2023, vključno s popravljeno različico 2023-09)

Ta slovenski standard je istoveten z: **EN ISO 20045:2024**

ICS:

13.040.01	Kakovost zraka na splošno	Air quality in general
17.240	Merjenje sevanja	Radiation measurements

SIST EN ISO 20045:2024 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 20045

July 2024

ICS 13.040.01; 17.240

English Version

Measurement of the radioactivity in the environment - Air: tritium - Test method using bubbler sampling (ISO 20045:2023, including corrected version 2023-09)

Mesurage de la radioactivité dans l'environnement - Air : tritium - Méthode d'essai à l'aide d'un prélèvement par barbotage (ISO 20045:2023, y compris version corrigée 2023-09)

Bestimmung der Radioaktivität in der Umwelt - Luft: Tritium - Messverfahren mit Sammlung mittels Gaswaschflaschen (ISO 20045:2023, einschließlich der korrigierten Fassung von 2023-09)

This European Standard was approved by CEN on 7 July 2024.

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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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

The text of ISO 20045:2023, including corrected version 2023-09 has been prepared by Technical Committee ISO/TC 85 “Nuclear energy, nuclear technologies, and radiological protection” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 20045:2024 by Technical Committee CEN/TC 430 “Nuclear energy, nuclear technologies, and radiological protection” the secretariat of which is held by AFNOR.

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 2025, and conflicting national standards shall be withdrawn at the latest by January 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.

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Endorsement notice

The text of ISO 20045:2023, including corrected version 2023-09 has been approved by CEN as EN ISO 20045:2024 without any modification.

INTERNATIONAL STANDARD

ISO 20045

First edition
2023-05

Corrected version
2023-09

Measurement of the radioactivity in the environment — Air: tritium — Test method using bubbler sampling

Mesurage de la radioactivité dans l'environnement — Air : tritium — Méthode d'essai à l'aide d'un prélèvement par barbotage

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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 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).

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, SC 2, *Radiological protection*.

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 corrected version of ISO 20045:2023 incorporates the following corrections:

— editorial corrections have been made in Clause 1, 3.2, Table 2, 8.3.1.1, 8.3.2.1, 8.3.3.2 and Clause 9;

— Formula (17) and Formula (B.10) have been corrected.

Introduction

Everyone is exposed to natural radiation. The natural sources of radiation include cosmic rays and naturally occurring radioactive substances which exist on Earth such as flora, fauna or the human body. Human activities involving the use of radiation and radioactive substances add to the radiation exposure from this natural exposure. Some of those activities, such as the mining and use of ores containing naturally-occurring radioactive materials (NORM) and the production of energy by burning coal that contains such substances, simply enhance the exposure from natural radiation sources. Nuclear power plants and other nuclear installations use radioactive materials and produce radioactive effluents and waste during operation and decommissioning. The use of radioactive materials in industry, medicine, agriculture and research is expanding around the globe.

All these human activities give rise to radiation exposures that are only a small fraction of the global average level of natural exposure. The medical use of radiation is the largest and a growing man-made source of radiation exposure in developed countries. It includes diagnostic radiology, radiotherapy, nuclear medicine and interventional radiology.

Radiation exposure also occurs as a result of occupational activities. It is incurred by workers in industry, medicine and research using radiation or radioactive substances, as well as by passengers and crew during air travel. The average level of occupational exposures is generally below the global average level of natural radiation exposure (see Reference [2]).

As uses of radiation increase, so do the potential health risk and the public's concerns. Thus, all these exposures are regularly assessed in order to

a) improve the understanding of global levels and temporal trends of public and worker exposure,

b) evaluate the components of exposure so as to provide a measure of their relative impact, and

c) identify emerging issues that may warrant more attention and study. While doses to workers are mostly directly measured, doses to the public are usually assessed by indirect methods using the results of radioactivity measurements of waste, liquid and/or gaseous effluents and/or environmental samples.

Radioactivity from several naturally-occurring and anthropogenic sources is present throughout the environment. Thus, atmosphere can contain radionuclides of natural, human-made, or 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 and ^{210}Pb which can be found in materials from natural sources or can be released from technological processes involving naturally occurring radioactive materials (e.g. the mining and processing of mineral sands or phosphate fertilizer production and use).

— Human-made radionuclides, such as transuranic elements (americium, plutonium, neptunium, and curium), ^{3}H, ^{14}C, ^{90}Sr and gamma-ray emitting radionuclides can also be found gaseous effluent discharges, in environmental matrices (water, air, soil and biota), in food and in animal feed as a result of authorized releases into the environment, fallout from the explosion in the atmosphere of nuclear devices and radionuclides releases from accidents of nuclear reactors, such as those that occurred in Chernobyl and Fukushima.

To ensure that the data obtained from radioactivity monitoring programs support their intended use, it is essential that the stakeholders (for example nuclear site operators, regulatory and local authorities) agree on appropriate methods and procedures for obtaining representative samples and for sampling, handling, storing, preparing and measuring the test samples. An assessment of the overall measurement uncertainty also needs to be carried out systematically. As reliable, comparable and 'fit for purpose' data are an essential requirement for any public health decision based on radioactivity measurements, international standards of tested and validated radionuclide test methods are an important tool for the production of such measurement results. The application of standards serves also to guarantee comparability of the test results over time and between different testing laboratories. Laboratories apply them to demonstrate their technical competencies and to complete proficiency tests successfully during interlaboratory comparisons, two prerequisites for obtaining national accreditation.

Today, over a hundred International standards, prepared by Technical Committees of the International Organization for Standardization, including those produced by ISO/TC 85, and the International Electrotechnical Commission (IEC), are available to testing laboratories for measuring radionuclides in different matrices.

Tritium (^{3}H) is a radioactive isotope of hydrogen. It is a pure beta emitting radionuclide, with a maximum energy equal to 18,591 ± 1 keV and a radiological half-life equal to 12,312 (0,025) years (see Reference [3]). It is naturally occurring and continuously produced in the upper atmosphere by interaction of cosmic rays with nitrogen and oxygen nuclei (see Reference [4]).

Two main chemical species of both natural and anthropogenic tritium are present in the environment. The most abundant chemical form is tritiated water (HTO) (see Reference [5]). Tritium can also be present in the form of tritiated gas (HT or T_2) usually present in the vicinity of tritium-emitting facilities (see Reference [6]), tritiated methane (CH_3T), or in other various organic forms of tritium commonly observed in terrestrial, aquatic continental, and marine ecosystems (see References [7], [8] and [9]).

Anthropogenic tritium compounds come from radioactive releases of nuclear facilities i.e., nuclear power plants, irradiated fuel reprocessing and recycling plants, military defence, medical research applications, and past atmospheric testing of nuclear devices (see Annex A).

This document describes the method to assess the activity concentration of atmospheric tritium via air sampling by bubbler devices which trap tritiated water vapour and tritiated gas in a water solution. The method can be used for any type of environmental study or monitoring.

The test method is used in the context of a quality assurance management system (ISO/IEC 17025). It can be adapted so that the characteristic limits, decision threshold, detection limit and uncertainties ensure that the test results of the atmospheric tritium activity concentrations can be verified to be below guidance levels required by a national authority for either planned or existing situations or for an emergency situation.