

ISO/FDIS 18589-7:2025(en)

ISO/TC 85/SC 2/WG 17

Secretariat: AFNOR

Date: 2025-06-1908

Measurement of radioactivity in the environment — Soil —

Part 7:
In situ measurement of gamma-emitting radionuclides

Mesurage de la radioactivité dans l'environnement — Sol —

Partie 7: Mesurage in situ des radionucléides émetteurs gamma

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/FDIS 18589-7

<https://standards.iteh.ai/standards/iso/3e3b4c01-a619-4a38-be9d-46d28b4ad008/iso-fdis-18589-7>

FDIS stage

ISO/FDIS 18589-7:2025(en)

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
~~Email~~**E-mail**: copyright@iso.org
Website: www.iso.org

Published in Switzerland

iTeh Standards (<https://standards.iteh.ai>) Document Preview

ISO/FDIS 18589-7

<https://standards.iteh.ai/catalog/standards/iso/3e3b4c01-a619-4a38-be9d-46d28b4ad008/iso-fdis-18589-7>

Contents

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols	4
5 Principles	6
5.1 Measurement method	6
5.2 Uncertainties of the measurement method	7
6 Equipment	7
6.1 Portable in situ spectrometry system	7
6.2 Detector system	8
6.3 Pulse processing electronics	9
6.4 Assembly jig for a detector system	10
6.5 Collimated detector	10
7 Procedure	13
7.1 Calibration	13
7.2 Method of combined calibrations	14
8 Quality assurance and quality control program	18
8.1 General	18
8.2 Influencing variables	18
8.3 Instrument verification	18
8.4 Method verification	18
8.5 Quality control program	18
8.6 Standard operating procedure	20
9 Expression of results	20
9.1 Calculation of activity per unit of surface area or unit of mass	20
9.2 Calculation of the characteristic limits and the best estimate of the measurand as well as its standard uncertainty	20
9.3 Calculation of the radionuclide specific ambient dose rate	23
10 Test report	24
Annex A (informative) Influence of radionuclides in air on the result of surface or mass activity measured by in situ gamma spectrometry	25
Annex B (informative) Influence quantities	26
Annex C (informative) Characteristics of germanium detectors	29
Annex D (informative) Field-of-view of an in situ gamma spectrometer as a function of the photon energy for different radionuclide distributions in soil	31
Annex E (informative) Methods for calculating geometry factors and angular correction factors	35
Annex F (informative) Example for calculation of the characteristic limits as well as the best estimate of the measurand and its standard uncertainty	42
Annex G (informative) Conversion factors for surface or mass activity to air kerma rate and ambient dose equivalent rate for different radionuclide distribution in soil	46

ISO/FDIS 18589-7:2025(en)

Annex H (informative) Mass attenuation factors for soil and attenuation factors for air as a function of photon energy and deviation of $G(E,V)$ for different soil compositions	53
Bibliography	55

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ISO/FDIS 18589-7](https://standards.itih.ai/catalog/standards/iso/3e3b4c01-a619-4a38-be9d-46d28b4ad008/iso-fdis-18589-7)

<https://standards.itih.ai/catalog/standards/iso/3e3b4c01-a619-4a38-be9d-46d28b4ad008/iso-fdis-18589-7>

ISO/FDIS 18589-7:2025(en)

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 ~~TC 85, Nuclear energy, nuclear technologies, and radiological protection~~, Subcommittee SC 2, *Radiological protection*, ~~in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 430, Nuclear energy, nuclear technologies, and radiological protection in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement)~~.

This second edition cancels and replaces the first edition (ISO ~~18549~~ 18589-7:2013), of which ~~has been technically revised~~ it constitutes a minor revision.

The main changes are as follows:

- ~~B.10~~ ~~B.10~~: correction of the information related to the activity concentration of 40 K;
- ~~E.2~~ ~~E.2~~ and ~~E.6~~ ~~E.6~~: correction of ~~0~~ ~~Formulae (E.5)~~ and ~~0~~ ~~(E.11)~~;
- ~~F.4~~ ~~F.4~~: correction of β , according to the numerical values of the example;
- ~~F.6~~ ~~F.6~~: modify $\beta = 50 \text{ g cm}^{-2}$ into $\beta = 50 \text{ kg m}^{-2}$;
- ~~G.3~~ ~~G.3~~, Footnote 1 of ~~Table G.3~~ ~~Table G.3~~: modify $1 \text{ g cm}^{-2} = 10 \text{ kg cm}^{-2}$ into $1 \text{ g cm}^{-2} = 10 \text{ kg m}^{-2}$.

A list of all parts in the ISO 18589 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.

Introduction

In situ gamma spectrometry is a rapid and accurate technique to assess the activity concentration of gamma-emitting radionuclides present in the top soil layer or deposited onto the soil surface. This method is also used to assess the dose rates of individual radionuclides.

In situ gamma spectrometry is a direct physical measurement of radioactivity that does not need any soil samples, thus reducing the time and cost of laboratory analysis of large number of soil samples.

The quantitative analysis of the recorded line spectra requires a suitable area for the measurement. Furthermore, it is required to know the physicochemical properties of the soil and the vertical distribution in the soil to assess the activity of the radionuclides.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/FDIS 18589-7

<https://standards.iteh.ai/catalog/standards/iso/3e3b4c01-a619-4a38-be9d-46d28b4ad008/iso-fdis-18589-7>

Measurement of radioactivity in the environment — Soil — Part 7: ~~In situ measurement of gamma-emitting radionuclides — Soil —~~

Part 7: In situ measurement of gamma-emitting radionuclides

1 Scope

This ~~part of ISO 18589~~ document specifies the identification of radionuclides and the measurement of their activity in soil using in situ gamma spectrometry with portable systems equipped with germanium or scintillation detectors.

This ~~part of ISO 18589~~ document is suitable to rapidly assess the activity of artificial and natural radionuclides deposited on or present in soil layers of large areas of a site under investigation.

This ~~part of ISO 18589~~ document can be used in connection with radionuclide measurements of soil samples in the laboratory (see ISO 18589-3) in the following cases:

- ~~routine~~ surveillance of the impact of radioactivity released from nuclear installations or of the evolution of radioactivity in the region;
- investigations of accident and incident situations;
- ~~planning and surveillance of remedial action;~~
- decommissioning of installations or the clearance of materials.

It can also be used for the identification of airborne artificial radionuclides, when assessing the exposure levels inside buildings or during waste disposal operations.

Following a nuclear accident, in situ gamma spectrometry is a powerful method for rapid evaluation of the gamma activity deposited onto the soil surface as well as the surficial contamination of flat objects.

NOTE The method described in this ~~part of ISO 18589~~ document is not suitable when the spatial distribution of the radionuclides in the environment is not precisely known (influence quantities, unknown distribution in soil) or in situations with very high photon flux. However, the use of small volume detectors with suitable electronics allows measurements to be performed under high photon flux.

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

~~IEC 61275, Radiation protection instrumentation — Measurement of discrete radionuclides in the environment — In situ photon spectrometry system using a germanium detector~~

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