

ILNAS

Institut luxembourgeois de la normalisation
de l'accréditation, de la sécurité et qualité
des produits et services

ILNAS-EN ISO 20042:2021

Measurement of radioactivity - Gamma-ray emitting radionuclides - Generic test method using gamma-ray spectrometry (ISO 20042:2019)

Bestimmung der Radioaktivität -
Gammastrahlung emittierende
Radionuklide - Allgemeines
Messverfahren mittels

Mesurage de la radioactivité -
Radionucléides émetteurs gamma -
Méthode d'essai générique par
spectrométrie gamma (ISO 20042:2019)

08/2021

A decorative graphic in the bottom right corner featuring several interlocking gears in shades of blue and yellow. Overlaid on the gears is a vertical column of binary code (0s and 1s) and various mathematical symbols like plus, minus, and multiplication signs.

National Foreword

This European Standard EN ISO 20042:2021 was adopted as Luxembourgish Standard ILNAS-EN ISO 20042:2021.

Every interested party, which is member of an organization based in Luxembourg, can participate for FREE in the development of Luxembourgish (ILNAS), European (CEN, CENELEC) and International (ISO, IEC) standards:

- Participate in the design of standards
- Foresee future developments
- Participate in technical committee meetings

<https://portail-qualite.public.lu/fr/normes-normalisation/participer-normalisation.html>

THIS PUBLICATION IS COPYRIGHT PROTECTED

Nothing from this publication may be reproduced or utilized in any form or by any mean - electronic, mechanical, photocopying or any other data carries without prior permission!

ILNAS-EN ISO 20042:2021

EUROPEAN STANDARD **EN ISO 20042**

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2021

ICS 13.280

English Version

Measurement of radioactivity - Gamma-ray emitting radionuclides - Generic test method using gamma-ray spectrometry (ISO 20042:2019)

Mesurage de la radioactivité - Radionucléides émetteurs gamma - Méthode d'essai générique par spectrométrie gamma (ISO 20042:2019)

Bestimmung der Radioaktivität - Gammastrahlung emittierende Radionuklide - Allgemeines Messverfahren mittels Gammaskpektrometrie (ISO 20042:2019)

This European Standard was approved by CEN on 25 July 2021.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, 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: Rue de la Science 23, B-1040 Brussels

| Contents | Page |
|-------------------------------|-------------|
| European foreword..... | 3 |

European foreword

The text of ISO 20042:2019 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 20042:2021 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 February 2022, and conflicting national standards shall be withdrawn at the latest by February 2022.

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 is read in conjunction with EN XXX.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

Endorsement notice

The text of ISO 20042:2019 has been approved by CEN as EN ISO 20042:2021 without any modification.

**Measurement of radioactivity —
Gamma-ray emitting radionuclides —
Generic test method using gamma-ray
spectrometry**

*Mesurage de la radioactivité — Radionucléides émetteurs de
rayons gamma — Méthode d'essai générique par spectrométrie à
rayons gamma*



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2019

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
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

| | |
|---|-----------|
| Foreword | v |
| Introduction | vi |
| 1 Scope | 1 |
| 2 Normative references | 2 |
| 3 Terms and definitions | 2 |
| 4 Symbols and units | 5 |
| 5 Principle | 6 |
| 5.1 General..... | 6 |
| 5.2 Summing method..... | 6 |
| 5.3 Fitting method..... | 7 |
| 6 Validating measurements by gamma-ray spectrometry | 7 |
| 6.1 General..... | 7 |
| 6.2 Step 1: customer requirements..... | 8 |
| 6.3 Step 2: technical requirements..... | 8 |
| 6.4 Step 3: detailed design..... | 10 |
| 6.5 Step 4: installation..... | 10 |
| 6.6 Step 5: validation studies..... | 10 |
| 6.7 Step 6: robustness..... | 11 |
| 6.8 Step 7: operation and maintenance..... | 11 |
| 7 Nuclear decay data | 11 |
| 7.1 Recommended nuclear decay data..... | 11 |
| 7.2 Selection of gamma-ray photopeaks for inclusion in spectrum analysis libraries..... | 12 |
| 7.3 Decay chains..... | 12 |
| 8 Detector energy and efficiency calibration | 13 |
| 8.1 Energy calibration..... | 13 |
| 8.2 Efficiency calibration..... | 13 |
| 8.3 Source(s) for energy calibration..... | 14 |
| 8.4 Reference source(s) for efficiency calibration..... | 15 |
| 8.4.1 General..... | 15 |
| 8.4.2 Reference sources for laboratory systems..... | 15 |
| 8.4.3 Reference sources used with numerical methods..... | 15 |
| 9 Sample container | 15 |
| 10 Procedure | 16 |
| 10.1 Sample measuring procedure..... | 16 |
| 10.1.1 Sampling..... | 16 |
| 10.1.2 Sample preparation..... | 16 |
| 10.1.3 Loading the sample container..... | 18 |
| 10.1.4 Recording the sample spectrum..... | 18 |
| 10.2 Analysis of the spectrum..... | 18 |
| 10.2.1 Procedure for laboratory-based measuring systems..... | 18 |
| 10.2.2 Background corrections..... | 19 |
| 11 Expression of results | 20 |
| 11.1 Calculation of activity and activity per kg (or m ³) of sample..... | 20 |
| 11.2 Determination of the characteristic limits..... | 21 |
| 12 Test report | 21 |
| Annex A (informative) Quality assurance and quality control program | 22 |
| Annex B (informative) Corrections to the analysis process | 24 |
| Annex C (informative) Uncertainty budget | 29 |

| | |
|---|-----------|
| Annex D (informative) Detector types | 32 |
| Annex E (informative) Example: Calculation of ^{137}Cs activity content and characteristic limits in an aqueous sample | 35 |
| Annex F (informative) Example: Simulating correction factors for sample positioning, geometry, matrix, density and true summing | 40 |
| Bibliography | 49 |