International Standard

ISO 11483

Nuclear fuel technology — Preparation of plutonium sources and determination of $^{238}Pu/^{239}Pu$ isotope ratio by alpha spectrometry

Technologie du combustible nucléaire — Préparation des sources de plutonium et détermination du rapport isotopique $^{238}Pu/^{239}Pu$ par spectrométrie alpha

Third edition
2026-09

Reference number
ISO 11483:2026(en)

© ISO 2026



COPYRIGHT PROTECTED DOCUMENT

© ISO 2026

All rights reserved.

This ISO publication is protected by copyright and is owned by ISO and/or its licensors.

The content of this ISO publication is provided under licence, not sold. Use is subject to the applicable licence terms issued by ISO, an ISO member body, or an authorized third-party distributor.

Except as required for implementation or expressly permitted by a separate licence, no part of this ISO publication may be reproduced, distributed, modified, used, or made available in any form or by any means – electronic or mechanical, including photocopying, scanning, recording, or posting on internal or external digital platforms.

Any use beyond the scope of the granted rights is prohibited and may result in legal action.

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

Published in Switzerland

Contents

Page

Foreword ... **iv**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Principle ... **1**
5 Reagents ... **2**
6 Apparatus ... **2**
7 Source preparation ... **3**
7.1 General ... 3
7.2 Source preparation by drop deposition ... 3
7.2.1 Source preparation on electrochemically polished stainless-steel disc [2] ... 3
7.2.2 Source preparation on porcelain disc [3] ... 3
7.3 Source preparation by electrodeposition [4] [5] ... 4
8 Alpha spectrometry ... **4**
8.1 Measurement ... 4
8.2 Spectra evaluation ... 4
8.2.1 General ... 4
8.2.2 Geometric-progression decrease method [9] ... 5
8.2.3 Exponential decrease method ... 7
9 Expression of results ... **8**
10 Interference of americium ... **8**
11 Uncertainty evaluation ... **9**
12 Interferences ... **9**
Annex A (informative) **Combined standard uncertainty evaluation** ... **10**
Bibliography ... **16**

© ISO 2026 – All rights reserved

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 document 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 ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection,* Subcommittee SC 5, *Nuclear installations, processes and technologies*.

This third edition cancels and replaces the second edition (ISO 11483:2005), which has been technically revised.

The main changes are as follows:

— normative references and Terms and definitions have been added in Clause 2 and Clause 3;

— chemical reagents and apparatus have been listed as independent clauses;

— resolution of the alpha spectra, Repeatability and Reproducibility have been deleted;

— uncertainty evaluation has been added in Clause 11;

— the data in Table 1 have been updated.

A list of all parts in the ISO 11483 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 2026 – All rights reserved

Nuclear fuel technology — Preparation of plutonium sources and determination of $^{238}Pu/^{239}Pu$ isotope ratio by alpha spectrometry

1 Scope

This document describes the procedures to prepare plutonium sources and to measure the activity ratio of ^{238}Pu to (^{239}Pu + ^{240}Pu) by alpha spectrometry. The alpha spectrometry method is used for the determination of isotopic abundance of ^{238}Pu in combination with isotope-amount ratios determined by mass spectrometry after a preliminary separation of plutonium from uranium and fission products which eliminates the possible isobaric interferences of ^{238}U in the latter method. It is applied to the analysis of purified solutions of plutonium in 2 mol/l to 4 mol/l of nitric acid containing 50 µg to 200 µg of plutonium per millilitre, as can result from the chemical treatment and purification preceding plutonium isotopic analysis by mass spectrometry.

This document is applied to plutonium solutions free from ^{241}Am and those containing less than 10 % of other non-volatile impurities relative to the plutonium content. Otherwise purification is carried out in accordance with ISO 8299 [1].

The methods provided in this document are intended for use in conjunction or in parallel with mass spectrometry for the isotopic analysis of plutonium in spent-fuel solutions or nuclear-grade plutonium products.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Principle

Appropriate amount of plutonium solution is mixed with a wetting agent on an electrochemically polished stainless-steel disc or glazed porcelain disc and then dried. The dried residue is heated to red heat in flame or on an electric burner to produce a thin and carrier-free source. Alternatively the plutonium is electrodeposited as hydrous oxide from a buffered, slightly acidic aqueous solution onto a stainless-steel disc.

The source is measured by alpha spectrometry with a semiconductor detector.

The spectrum is processed to obtain the activity ratio of ^{238}Pu to (^{239}Pu + ^{240}Pu). The tailing of the ^{238}Pu peak is corrected by the “geometric-progression decrease” method or exponential extrapolation method.

The isotope-amount ratio $^{238}Pu/^{239}Pu$ is calculated using the isotope-amount ratio $^{240}Pu/^{239}Pu$ determined by mass spectrometry.

© ISO 2026 – All rights reserved