



International
Standard

ISO 18990

**Measurement of radioactivity in
urine- ^{238}Pu , ^{239}Pu and ^{240}Pu — Test
method using alpha spectrometry
or ICP-MS**

*Mesurage de la radioactivité dans les urines- ^{238}Pu , ^{239}Pu et
 ^{240}Pu — Méthode d'essai utilisant la spectrométrie alpha ou
l'ICP-MS*

**First edition
2025-12**

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

ISO 18990:2025

<https://standards.iteh.ai/catalog/standards/iso/e988d319-ad81-48ed-a0d0-fa2da1492a07/iso-18990-2025>

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

ISO 18990:2025

<https://standards.itih.ai/catalog/standards/iso/e988d319-ad81-48ed-a0d0-fa2da1492a07/iso-18990-2025>



COPYRIGHT PROTECTED DOCUMENT

© 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: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols	2
5 Principle	3
6 Chemical reagents and apparatus	5
6.1 Chemical reagents	5
6.2 Apparatus	5
7 Sample preparation procedure	6
7.1 General	6
7.2 Sample pre-concentration	6
7.3 Organics decomposition	6
7.4 Chemical separation	6
7.5 Sample preparation for measurement	7
7.5.1 Preparation for alpha spectrometry measurement	7
7.5.2 Preparation for ICP-MS measurement	7
8 Measurement	7
8.1 Alpha spectrometer measurement	7
8.2 ICP-MS measurement	7
9 Expression of results	7
10 Test report	8
11 Quality assurance and quality control program	8
11.1 General	8
11.2 Variables that can influence the measurement	9
11.3 Instrument verification	9
11.4 Contamination	9
11.5 Interference control	9
11.6 Method verification	9
11.7 Demonstration of analyst capability	10
Annex A (informative) Chemical separation of plutonium from 20 ml of urine sample	11
Annex B (informative) Chemical separation of plutonium from 100 ml of urine sample	13
Annex C (informative) Chemical separation of plutonium from a 24 h excretion urine sample	16
Annex D (informative) Preparation of the source by electrodeposition	20
Annex E (Informative) Preparation of the alpha source by lanthanide fluoride co-precipitation	23
Annex F (informative) Activity measurement and results expression when using the alpha spectrometry method	25
Annex G (informative) Measurement and results expression when using the ICP-MS method	32
Bibliography	37

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 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.

ISO 18990:2025

<https://standards.iteh.ai/catalog/standards/iso/e988d319-ad81-48ed-a0d0-fa2da1492a07/iso-18990-2025>

Introduction

In the course of employment, individuals might work with radioactive materials that, under certain circumstances, could be taken into the body. Minimising the risks to workers from incorporated radionuclides requires the monitoring of potential or actual intakes. This monitoring involves the measurement of the activity of the radionuclides in the body (in vivo measurement) and/or biological samples, e.g. urine or faeces (in vitro measurement).

Analytical methods for plutonium urine bioassay are addressed in this document because of:

- the convenience of urine sampling and relatively easy sample processing. Urine bioassay is the most commonly used in vitro measurement method for accurately assessing the magnitude of internal contamination;
- the high radiotoxicity of Pu isotopes (e.g. ^{238}Pu , ^{239}Pu and ^{240}Pu) due to their long half-lives, highly energetic alpha emission and ability to accumulate into bone and organs;
- the major contribution of Pu isotopes to the internal contamination in many situations, and the relatively low detection limits of Pu isotopes compared to the other highly radiotoxic actinides.

For routine individual monitoring, the detection of all exposures whose sum can lead to an annual dose exceeding 1 mSv should be ensured according to ISO 20553. In emergency situations, the urine bioassay techniques should be sufficiently sensitive to meet the maximum value for reference level of 0,1 Sv recommended by the International Commission on Radiological Protection (ICRP)^{[1][2][3]}.

This document offers general requirements for sample processing and measurement of the activity concentration of Pu isotopes in urine samples. Examples of detailed procedures are given in the annexes for different monitoring situations.

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

ISO 18990:2025

<https://standards.iteh.ai/catalog/standards/iso/e988d319-ad81-48ed-a0d0-fa2da1492a07/iso-18990-2025>

