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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

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Foreword

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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.