Certification of the uranium hexafluoride (UF6) isotopic composition: The IRMM-019 to IRMM-029 series
Abstract:
This report describes the re-determination and certification of the IRMM-019 to IRMM-029 series of uranium hexafluoride (UF6) reference materials certified for the uranium isotopic composition. The values were assigned following ISO Guide 34:2009. The IRMM-019 to IRMM-029 series was originally produced and certified in the 1980's-1990's. Since, the materials are stored in monel ampoules. Upon customer request, UF6 gas is distilled from a mother ampoule into a daughter ampoule, the isotopic
composition is verified by Gas Source Mass Spectrometry (GSMS) and the daughter ampoule is sent to the customer. For the purpose of this project, the UF6 materials were converted into uranium nitrate solutions to perform the homogeneity and characterisation studies. Between-unit homogeneity was quantified and stability during dispatch and storage were assessed in accordance with ISO Guide 35:2006. The materials were characterised by Thermal Ionisation Mass Spectrometry (TIMS) using newly established measurement procedures such as the Modified Total Evaporation (MTE) and Double Spike (DS) methods, and with a new set of certified uranium isotope reference materials, which were prepared by gravimetrical mixing of highly enriched 233U, 235U, 236U and 238U oxides or solutions. The results of the characterisation measurements were also confirmed by GSMS measurements using the original UF6 gases. Uncertainties of the certified values were estimated in compliance with the Guide to the Expression of Uncertainty in Measurement (GUM) and include uncertainties related to the characterisation measurements and the homogeneity study. The materials are intended for the calibration of methods, quality control purposes, and the assessment of method performance for isotope mass spectrometry. As with any certified reference material, they can also be used for validation studies. The CRMs are available in monel ampoules. Based on physical reasons, there is no minimum sample intake to be taken into account.