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Validation of Neptune Plus MC-ICP-MS for Bulk Analysis of Environmental Swipe Samples

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As part of the ECAS (Enhancing Capabilities of Safeguards Analytical Services) project a new generation multi collector inductively coupled plasma mass spectrometer (MC-ICP-MS) has been installed in the Environmental Sample Laboratory of the IAEA's Safeguards Analytical Laboratories for the bulk analysis of environmental swipe samples. Several analytical procedures have been validated for bulk analysis of environmental swipe samples. During the validation study the chemical sample preparation procedure has also been further improved.

The U and Pu isotope ratio measurements and the Pu isotope dilution analysis are performed with ThermoFisher Scientific Neptune Plus MC-ICP-MS coupled to a high-efficiency sample introduction system (Aridus II). Mass bias correction, background / memory effect correction, hydride formation correction, yield correction of the multi-collector ion counters, ion counter non-linearity and dead time correction, and peak-tailing correction are performed for isotope ratio measurements. The effect of potential molecular interferences is assessed by the screening of concentrations of interfering elements in uranium fractions.

The new procedures allow the determination of n(U-235)/n(U-238) with relative expanded uncertainties lower than 0.2%, allow achieving detection limits below 5•10-7 for n(U-233)/n(U-238) and below 1•10-7 for n(U-236)/n(U-238) in swipe samples, and allow achieving detection limits for the determination of 239Pu, 240Pu, 241Pu, and 244Pu amounts lower than 1 femtogram per aliquot.

Country or International Organization

International Atomic Energy Agency

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