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Measurement of the Pu Concentration of European MOX Pellets by Neutron Coincidence Counting

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A neutron-coincidence counter was calibrated for the non-destructive measurement of Pu concentration of mixed oxide (MOX) fuel pellets produced in Europe. The aim was to implement a non-destructive procedure for verifying the declared Pu inventory which can be used either by analysts in the lab or by safeguards inspectors in field.

A set of 6 MOX pellets taken from a MOX fuel fabrication facility and transported to the laboratory was used for the calibration. An older set of 5 pellets from the same facility was used to validate the calibration and to check the performance of the method. After recording gamma spectra and doing neutron measurements, both sets of pellets were characterized by destructive methods.

Two different calibration curves were prepared. For one of them the effects of sample self-multiplication were corrected for by using a simple correction factor. For the other one these effects were ignored. The bias between Pu concentrations obtained from neutron measurements and from isotope-dilution mass-spectrometry was calculated. It was found to be between 1 and 3 % depending on the calibration curve and on the source of isotopic data used for calculation.

This accuracy may be sufficient for a quick preliminary assessment of the Pu inventory in MOX pellets by in-field instruments to immediately spot possible Pu diversion. However, for material balance evaluation purposes the smaller uncertainties associated with destructive assay remain preferable.

Country or International Organization

European Union

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