

RADIOCHEMICAL ANALYSIS USED AT CEN-MOL FOR THE DETERMINATION OF α -EMITTERS IN BIOLOGICAL MATERIALS

N. M. VALENTIN, C. WEYERS and J. LUYSTERBORG

Centre d'Étude de l'Énergie Nucléaire, Mol, Belgium

Abstract—The radiochemical analysis used at CEN (Mol) for the determination of α -emitters in biological materials are of 2 types: the routine and the incident procedures. Three α -emitters are routinely detected in urine samples. These are uranium, plutonium and americium. The uranium is analyzed by a fluorimetric method using a mixture of NaF–LiF. The sensitivity of the method is $0.6 \mu\text{g U}/24 \text{ hr urine}$. Plutonium and americium are determined by a method involving the following steps: phosphate precipitation, ashing, ion exchange separation, electrode position and counting with a ZnS scintillator. The yield of recovery for each α -emitter is 75 ± 4 per cent (95 per cent confidence) and the sensitivity of the method is $0.06 \text{ dpm}/24 \text{ hr urine}$. In the case of an accidental contamination, nose blow, feces and urine samples are collected. Uranium, plutonium and americium can be determined in nose blow samples with an efficiency of 85 ± 10 per cent (95 per cent confidence) and a sensitivity of 0.02 dpm . The analysis consisted in a destruction of the organic material with a mixture of acids followed by an electrodeposition of the α -emitter and a counting in a ZnS scintillator. The analytical method used for feces containing plutonium or americium consists in a wet ashing followed by a calcium fluoride precipitation. The insoluble is filtered on a 100 cm^2 Millipore filter paper. The filter is counted in a ZnS scintillator counter. The recovery of the α -emitter is 84 ± 24 per cent (95 per cent confidence) and the sensitivity is $2.0 \text{ dpm}/24 \text{ hr sample}$. Urine samples collected, following an accidental contamination, are processed for plutonium and americium by the same method as feces samples. However the wet ashing step is replaced by an oxidation of the urine sample. The efficiency of the method is 90 ± 15 per cent (95 per cent confidence) and its sensitivity is $1 \text{ dpm}/24 \text{ hr urine}$.