THE USE OF ENVIRONMENTAL MONITORING AS A TECHNIQUE TO IDENTIFY ISOTOPIC ENRICHMENT ACTIVITIES

P39

J.E.S. Sarkis[a] and J.H. Buchman

[a] jesarkis@ipen.br

Nuclear and Energy Research Institute, São Paulo, Brazil

The use of environmental monitoring as a technique to identify activities related to the nuclear fuel cycle has been proposed, by international organizations, as an additional measure to the safeguards agreements in force. The elements specific for each kind of nuclear activity, or "nuclear signatures", inserted in the ecosystem by several transfer paths, can be intercepted with better or worse ability by different live organisms. Depending on the kind of signature of interest, the anthropogenic material identification and quantification require the choice of adequate biologic indicators and, mainly, the use of sophisticated techniques associated with elaborate sample treatments. This work demonstrates the technical viability of using pine needles as bioindicators of nuclear signatures associated with uranium enrichment activities. Additionally, it proposes the use of a technique widely diffused nowadays in the scientific community, the High Resolution Inductively Coupled Plasma Mass Spectrometer (HR-ICP-MS), to identify the signature corresponding to that kind of activities in the ecosystem. It can be also found a description of a methodology recently being applied in analytical chemistry, based on uncertainties estimates metrological concepts, used to calculate the uncertainties associated with the obtained measurement results. Nitric acid solutions with a concentration of 0.3 mol kg^{-1}, used to wash pine needles sampled near facilities that manipulate enriched uranium and containing only 0.1 g kg^{-1} of uranium, exhibit a ^{235}U:^{238}U isotopic abundance ratio of 0.0092 ? 0.0002, while solutions originated from samples collected at places located more than 200 km far from activities related to the nuclear fuel cycle exhibit a value of 0.0074 ? 0.0002 for this abundance ratio. Similar results were obtained for sample solutions prepared by microwave assisted acid digestion and dry ashing process. The different values of ^{235}U:^{238}U isotopic abundance ratio obtained for samples collected in different places permit to confirm the presence of anthropogenic uranium and demonstrate the viability of using this technique and the methodology proposed in this work.

This work was published as PhD thesis defended at IPEN (2000)